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Fouling invertebrates from PVC plates at Chahué Marina, Oaxaca, Southern Pacific coast of Mexico

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Abstract. The port fouling fauna from Mexico has recieved greater study in the last 15 years. By improving our knowledge of fouling invertebrates on artificial substrates on the Southern Pacific coast of Mexico, we can better understand their distribution and prevent bioinvasions. The specimens listed in this present study come from PVC plates that were placed between June 2019 to June 2020 submerged at 1 m depth, on four docks of the Chahué Marina, Oaxaca, Mexico. Forty-four taxa, representing nine phyla were identified: Sipuncula (1 species), Entoprocta (1), Bryozoa (3), Arthropoda (3), Porifera (4), Cnidaria (5), Chordata (6), Mollusca (10) and Annelida (11). Thirty taxa were identified to species, with two still requiring confirmation. Five were identified to genus, two to family, and five to class level. From the 30 identified species, 18 were non-native species: one entoproct, one mollusk, two bryozoans, three hydrozoans, three barnacles, four polychaetes, and four ascidians. These results include seven new records from the state of Oaxaca: one entoproct, one barnacle, two bryozoans, and three hydrozoans.

Key words. Annelids, ascidians, barnacles, bryozoans, entoprocts, hydrozoans, introduced species

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INTRODUCTION

Marine invertebrates can colonize any type of substrate, including human-made structures (Terlizzi and Faimali 2010). Coastlines, docks, piles, and ship hulls are frequently colonized by invertebrate communities, which is is commonly referred to as biofouling (Carlton 1987; Goldburg and Triplett 1997; Terlizzi and Faimali 2010). These fouled structures are of concern because they can be used as stepping stones by marine fauna, allowing the establishment and spread of both native and introduced species, which can adversely affect the local fauna and disrupt human activities (Okolodkov et al. 2007; Terlizzi and Faimali 2010; Bishop et al. 2017).

In Mexico, 139 marine introduced species are recorded, classified either as potentially invasive, invasive, or cryptogenic (Okolodkov et al. 2007; Bastida-Zavala et al. 2014; de León-González et al. 2021a). Of these, 102 species are distributed in the Mexican Pacific area, including sponges (e.g. Bastida-Zavala et al. 2014), cnidarians (e.g. Galván-Villa and Ríos-Jara 2018; Galván-Villa et al. 2023; Bastida-Zavala et al. 2024), polychaetes (e.g. Salgado-Barragán et al. 2004; Tovar-Hernández et al. 2009a; Bastida-Zavala and García-Madrigal 2012; Bastida-Zavala et al. 2014), mollusks (e.g. Salgado-Barragán and Toledano-Granados 2006), crustaceans (e.g. Rodríguez-Almaraz and García-Madrigal 2014), entoprocts (e.g. de León-González et al. 2021a), bryozoans (e.g. Medina-Rosas and Tovar-Hernández 2012; Tovar-Hernández et al. 2012), and ascidians (e.g. Salgado-Barragán et al. 2004; Bastida-Zavala et al. 2014; Tovar-Hernández et al. 2022).

Along the coast of Oaxaca, 1,765 marine and estuarine invertebrate species have been recorded in all habitats (mostly natural), belonging to fourteen phyla (Bastida-Zavala et al. 2013; Bastida-Zavala and García-Madrigal 2022). A few studies have been conducted in harbours, marinas, and ports, focusing on few families of polychaetes, hydroids, octocorals and bryozoans, with the goal of identifying the presence of introduced species (Bastida-Zavala et al. 2016; Bastida-Zavala et al. 2017; Humara-Gil and Cruz-Gómez 2018; Humara-Gil and Cruz-Gómez 2019; Bastida-Zavala et al. 2024). Despite these efforts, the knowledge about fouling marine invertebrates associated with artificial structures on the coast of Oaxaca is almost

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unknown. The main objective of this study is to record the fouling fauna found in artificial marine structures from the Chahué Marina, Oaxaca on the Southern Pacific coast of Mexico, constituting the first faunistic study in the region completely focused on artificial marine structures.

STUDY AREA

The Chahué Marina, which comprises an area of 36,230 m^2, has a main floating dock with three secondary docks. The marina is part of Chahué Bay, located on the central coast of Oaxaca at the western end of the Gulf of Tehuantepec, Mexico (Figure 1). It is characterized as an euryhaline environment (environments with wide salinity range). In the extreme northwest of the Marina, the Chahué channel allows for the arrival of fresh water, especially in the months of greatest precipitation (June to October), although Chahué Marina receives variable contributions of treated fresh water throughout the year, originating from the wastewater treatment plant located 700 m away. During the sampling period, the water temperature had a maximum value of 31 °C and a minimum value of 26.7 °C, with an annual average of 29.76 °C. Salinity ranged between 23.15 and 34.58, with an average of 29.66.

METHODS

The invertebrate specimens revised in this work came from polyvinyl chloride (PVC) plates, placed on four docks of the Chahué Marina in Chahué Bay, Oaxaca, Mexico (Figure 1). Five PVC plates (15 × 15 cm length and width, and 0.6 cm thick) were deployed at each dock on 1 June 2019. The exposed surface of each plate was previously sanded. A fragment of brick was fixed on the opposite side to prevent the plates from floating. Each plate was tied with rope and secured to the dock with staples. The plates were submerged at 1 m depth, with a minimum horizontal separation between plates of 2 m. After three months, three plates at each location were removed and three new plates were submerged, until one year of study was completed, on 6 June 2020.

The specimens were obtained using a suprabenthic net with a 500 µm mesh opening; subsequently, the brick was removed, and the plates were placed in plastic bags (Ziploc). Due to time constraints, the specimens were not relaxed but rather fixed using a 4% formalin seawater solution inside the bag. The specimens were then washed and removed by scraping the exposed side of the plate, then preserved in 70% ethanol.

Finally, the specimens were observed under a stereoscopic and optical microscope. Identification keys and specialized literature for each taxon were used for the identification to the lowest taxonomic level possible. The keys used were: for sponges (Cruz-Barraza and Carballo 2008), hydrozoans (Humara-Gil and Cruz-Gómez 2018; Calder et al. 2019, 2021, 2022), polychaetes (de León-González et al. 2021b), sipunculans (Silva-Morales and Gómez-Vásquez 2021), mollusks (Keen 1961, 1971), entoprocts (Osburn 1953; Wasson and Mariscal 2007), bryozoans (Osburn 1940, 1952, 1953; Winston 1982; Ryland 1960), crustaceans (Darwin 1854; Pilsbry 1916; Harding 1962; Henry and McLaughlin 1975), and ascidians (Van Name 1921, 1945; Tokioka 1967; Moreno-Dávila 2010).

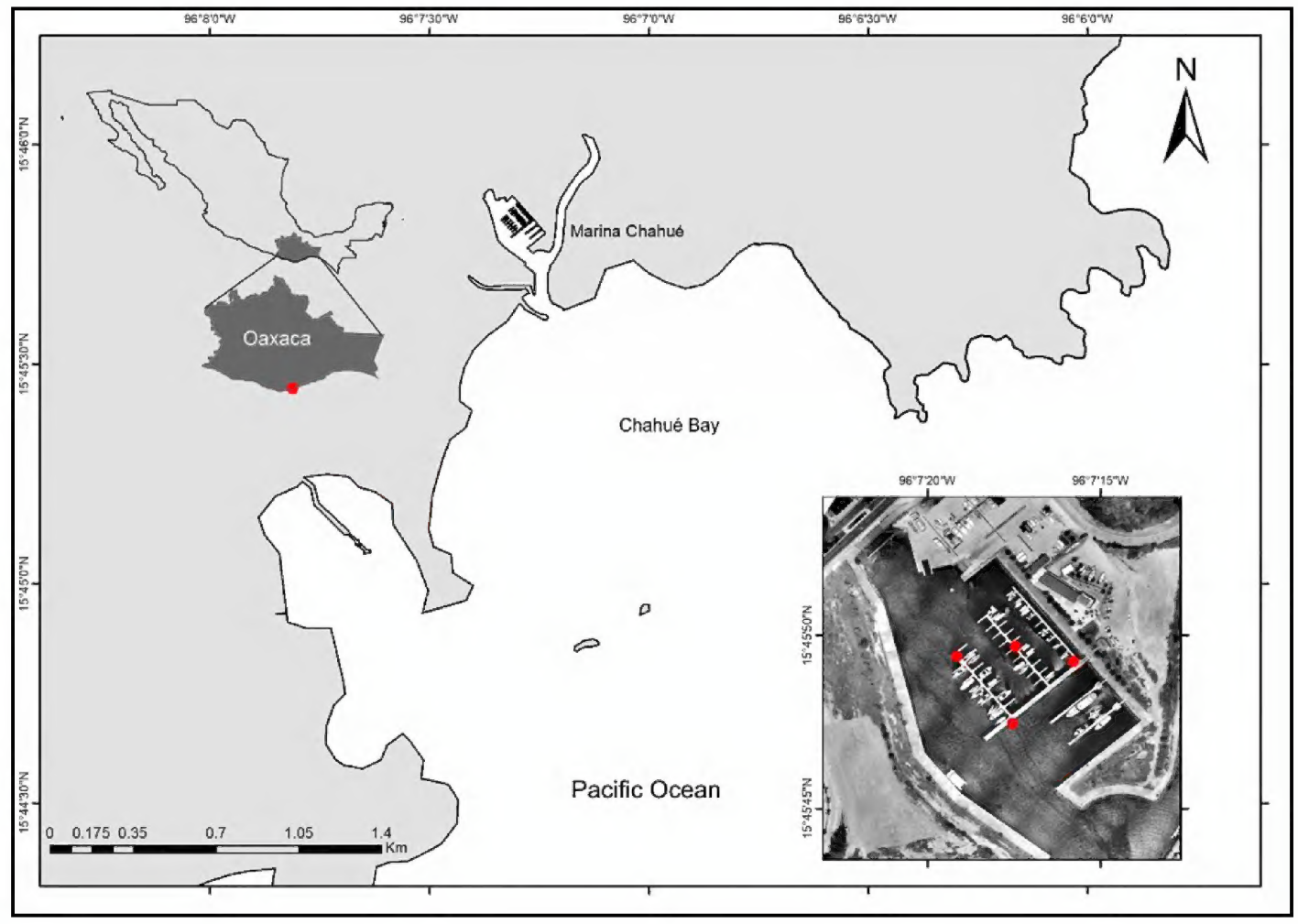

Figure 1. Location of the Chahué Marina at the Chahué Bay, Bahías de Huatulco, Oaxaca, Mexico. Red points indicate the sampling sites in the docks.

The specimens identified at genus, family, or class levels (family and class labeled as not identified = NI) are listed in the results (Table 1), and those identified to species level are detailed in the systematics section, with taxa listed in phylogenetic order. All taxonomic names were compared to WoRMS (2024) to confirm that the names were valid. Although the peanut worms (Sipuncula), could be included as annelids based on molecular analyses (e.g. Struck et al. 2007), we decided to maintain them as a separate phylum in agreement with the arguments provided by Schulze et al. (2019).

All studied material was deposited in the Scientific Collection (OAX-CC-249-11) of the Laboratorio de Sistemática de Invertebrados Marinos (LABSIM), Universidad del Mar (UMAR), Puerto Ángel, Oaxaca, Mexico. The abbreviations used in the material examined for catalogue numbers for each taxon are as follows: Hydrozoa (UMAR-HYDR), Polychaeta (UMAR-POLY), Sipuncula (UMAR-SIPU), Bivalvia (UMAR-BIVA), Gastropoda (UMAR-GAST), Crustacea (UMAR-THOR), Entoprocta (UMAR-ENTO), Bryozoa (UMAR-BRYO), and Ascidiacea (UMAR-ASCI).

RESULTS

A total of 12,994 fouling invertebrate specimens and 146 colonies were examined. Forty-four taxa were identified belonging to nine phyla: Porifera (4), Cnidaria (5), Annelida (11), Sipuncula (1), Mollusca (10), Arthropoda (3), Entoprocta (1), Bryozoa (3), and Chordata (6) (Table 1).

Thirty taxa were identified to species level, six of which represent new records for the Southern Mexican Pacific and seven are new records for Oaxaca. Twelve introduced species are recorded for the first time at Chahué Marina, increasing the known number of introduced species at this marina to 18 (Table 1).

The following specimens could not be identified to a lower taxonomic level due to poor fixation (sponges) or because they were a juvenile stage (bivalve mollusks): Demospongiae NI 1 (Figure 2A), Demospongiae NI 2 (Figure 2B, C), Demospongiae NI 3 (Figure 2D, E), Bivalvia NI 1 (Figure 6F) and Bivalvia NI 2 (Figure 6C).

Table 1. List of taxa collected at fouling plates from Chahué Marina, Oaxaca, Mexico, status and previous records in the Tropical Eastern Pacific. Nat= native species; INT= introduced species, Unk= unknown; NR= new record. Abbreviations of Mexican states: BC= Baja California; BCS= Baja California Sur; COL= Colima; GRO= Guerrero; JAL= Jalisco; MIC= Michoacán; NAY=Nayarit; OAX= Oaxaca; SIN= Sinaloa; SON= Sonora. The new records for the state of Oaxaca are marked with an asterisk (*).

Taxa	Status	Tropical Eastern Pacific records
Phylum Porifera		
Cliona sp.	Unk	This work
Demospongiae NI 1	Unk	This work
Demospongiae NI 2	Unk	This work
Demospongiae NI 3	Unk	This work
Phylum Cnidaria		
Bougainvillia muscus (Allman, 1863) *	INT	Southern Pacific (Schuchert 1996); Galapagos (Calder et al. 2019)
Corydendrium flabellatum Fraser, 1938 *	Unk	Central American Pacific (Fraser 1938a: Panama)
Obelia oxydentata Stechow, 1914 *	INT	Galapagos (Calder et al. 2019)
Pennaria disticha Goldfuss, 1820	Unk	Southern California (Fraser 1938b); Southern Mexican Pacific (Humara-Gil and Cruz-Gómez 2018: Oaxaca)
Ventromma halecioides (Alder, 1859)	INT	Northern Mexican Pacific (Fraser 1948: Baja California); Gulf of California (Mendoza-Becerril et al. 2020: La Paz, BCS); Southern Mexican Pacific (Humara-Gil and Cruz-Gómez 2018: Oaxaca); Galapagos and Ecuador (Calder et al. 2003, 2019, 2021)
Phylum Annelida		
Branchiomma bairdi (McIntosh, 1885)	INT	Gulf of California (Tovar-Hernández et al. 2009a, 2009b, 2012, 2014: La Paz, BCS, Guaymas and San Carlos, SON, Guasave, Ahome, Mazatlán and Topolobampo, SIN; Bastida-Zavala et al. 2016: Bahía de los Ángeles, BC); Southern Mexican Pacific (Bastida-Zavala et al. 2016: Oaxaca); Galapagos (del Pasqua et al. 2018; Keppel et al. 2019)
Dipolydora sp.	Unk	This work
Hydroides brachyacantha Rioja, 1941	Nat	Gulf of California (Rioja 1941a: Mazatlán, SIN; Bastida-Zavala 2008: Cabo Pulmo Reef, BCS; Tovar-Hernández et al. 2009b: Mazatlán, SIN; Sun et al. 2016); Central Mexican Pacific (Rioja 1960: Socorro Island, COL; Morales de Anda et al. 2013: Navidad Bay, JAL; Yáñez-Rivera et al. 2020: Chamela, JAL; Galván-Villa et al. 2023: Manzanillo, COL); Southern Mexican Pacific (Rioja 1941a: Acapulco, GRO; Bastida-Zavala 2008: Guerrero and Oaxaca; Bastida-Zavala et al. 2016: Oaxaca); Central American Pacific (López-García et al. 1997: Panama; Bastida-Zavala and ten Hove 2003: Costa Rica, Panama and Ecuador)
Hydroides dirampha Mörch, 1863	INT	Gulf of California (Rioja 1941a: Mazatlán, SIN; Bastida-Zavala 1993; Bastida-Zavala and ten Hove 2003: La Paz, BCS; Bastida-Zavala 2008: Mazatlán, SIN; Tovar-Hernández et al. 2014: Guaymas, SON and La Paz, BCS; Bastida-Zavala et al. 2016: BCS); Southern Mexican Pacific (Rodríguez-Valencia 2004: Petacalco, GRO; Bastida-Zavala et al. 2016: Oaxaca); Central American Pacific (Nelson-Smith 1967: Panama Canal)

Taxa	Status	Tropical Eastern Pacific records
Hydroides elegans (Haswell, 1883)	INT	Gulf of California (Bastida-Zavala 2008: La Paz, BCS; Tovar-Hernández et al. 2009b: Mazatlán, SIN; Tovar-Hernández et al. 2014: Topolobampo, SIN, Guaymas, SON and La Paz, BCS; Bastida-Zavala et al. 2016: BCS); Central Mexican Pacific (Galván-Villa et al. 2023: Manzanillo, COL); Southern Mexican Pacific (Rodríguez-Valencia 2004: Petacalco, GRO; Bastida-Zavala *et al.* 2016: Oaxaca); Galapagos (Keppel et al. 2019)
Hydroides sanctaecrucis Krøyer in Mörch, 1863	INT	Gulf of California (Tovar-Hernández et al. 2014: Topolobampo, SIN, Guaymas, SON and La Paz, BCS; Bastida-Zavala *et al.* 2016: BCS); Southern Mexican Pacific (Bastida-Zavala and ten Hove 2002; Bastida-Zavala 2008; Bastida-Zavala *et al.* 2016: Oaxaca); Central American Pacific (Bastida-Zavala and ten Hove 2002: Panama); Galapagos (Keppel et al. 2019)
Maldanidae NI	Unk	This work
Parasabella cf. *lacunosa*	Unk	This work
Polydora sp.	Unk	This work
Spirobranchus minutus (Rioja, 1941)	Nat	Western coast of Baja California Peninsula (Berkeley and Berkeley 1958: Abreojos Point, BCS); Gulf of California (Rioja 1942: Mazatlán, SIN and Río Mayo, SON; Rioja 1947: Mapahui, Topolobampo and Navachiste, SIN; Rioja 1963: Mazatlán, SIN and Guaymas, SON; Bastida-Zavala 1993: La Paz Bay, BCS; Bastida-Zavala 1995: Cabo Pulmo Reef, BCS; Bastida-Zavala 2008: La Paz Bay and Cabo Pulmo Reef, BCS); Central Mexican Pacific (Bastida-Zavala et al. 2016: Caleta de Campos, MIC; Yáñez-Rivera et al. 2020: Chamela, JAL; Galván-Villa et al. 2023: Manzanillo, COL); Southern Mexican Pacific (Rioja 1941b: Acapulco, GRO; Rioja 1963: Zihuatanejo, GRO; Bastida-Zavala 2008: Acapulco, GRO and Oaxaca; Bastida-Zavala et al. 2016: Guerrero and Oaxaca); Central American Pacific (Bastida-Zavala 2008: Costa Rica and Perú)
Streblosoma sp.	Unk	This work
Phylum Sipuncula		
Phascolosoma (P.) puntarenae Grube, 1858	Nat	Gulf of California (Fisher 1952: BCS and SON; Gómez-Vásquez 2024: La Paz Bay, BCS); Central Mexican Pacific (Gómez-Vásquez 2024: NAY and JAL); Southern Mexican Pacific (Silva-Morales and Gómez-Vásquez 2021: Guerrero and Oaxaca); Central American Pacific (Grube 1858; Dean 2001, Dean et al. 2010: Costa Rica)
Phylum Mollusca		
Bivalvia NI 1	Unk	This work
Bivalvia NI 2	Unk	This work
Calyptraeidae NI	Unk	This work
Crucibulum spinosum (G.B. Sowerby I, 1824)	Nat	Southern California (Sowerby I 1824); Southern Mexican Pacific (Holguín-Quiñones and González-Pedraza 1989: Oaxaca)
Leiosolenus aristatus (Dillwyn, 1817)	INT	Gulf of California (Carpenter 1857: Mazatlán, SIN); Southern Mexican Pacific (Holguin-Quiñones and González-Pedraza 1989: Huatulco, OAX)
Ostrea conchaphila Carpenter, 1857	Nat	Gulf of California (Carpenter 1857: Mazatlán, SIN); Southern Mexican Pacific (Holguín-Quiñones and González-Pedraza 1989: Salina Cruz, OAX)
Saccostrea palmula (Carpenter, 1857)	Nat	Gulf of California (Carpenter 1857); Southern Mexican Pacific (Holguín-Quiñones and González-Pedraza 1989: Huatulco, OAX)
Striostrea prismatica (Gray, 1825)	Nat	Southern Mexican Pacific (Holguín-Quiñones and González-Pedraza 1989: OAX); Central American Pacific (Carpenter 1864: Panama)
Thylacodes margaritaceus (Rousseau in Chenu, 1844)	Nat	Southern Mexican Pacific (Gamboa-Contreras and Tapia-García 1998: Gulf of Tehuantepec, OAX)
Thylaeodus indentatus (Carpenter, 1857)	Nat	Gulf of California (Carpenter 1857); Southern Mexican Pacific (Rodríguez-Palacios et al. 1988: Oaxaca)
Phylum Arthropoda		
Amphibalanus amphitrite (Darwin, 1854)	INT	Gulf of California (Henry and McLaughlin 1975: Guaymas, Empalme, Bocochibampo Bay, San Carlos, SON, Mazatlán, SIN; Salgado-Barragán and Hendrickx 2002: Urías Estuary, SIN; Gómez-Daglio and González 2006: La Paz Bay, BCS); Southern Mexican Pacific (Henry and McLaughlin 1975: Acapulco, GRO; Gamboa-Contreras and Tapia-García 1998: Gulf of Tehuantepec, OAX); Central American Pacific (Spivey 1976: Panama)
Amphibalanus eburneus (Gould, 1841) *	INT	Gulf of California (Henry and McLaughlin 1975: Guaymas, SON, Mazatlán, SIN; Salgado-Barragán and Hendrickx 2002: Urías Estuary, SIN); Central Mexican Pacific (Henry and McLaughlin 1975: Manzanillo, COL); Central American Pacific (Matsui et al. 1964: Panama; Lozano-Cortés and Londoño-Cruz 2013: Colombia)

Taxa	Status	Tropical Eastern Pacific records
Balanus trigonus Darwin, 1854	INT	Western coast of Baja California Peninsula (Pilsbry 1916: Magdalena Bay, BCS; Henry and McLaughlin 1975: off Magdalena Bay, BCS); Gulf of California (Henry 1943: Agiabampo Estuary, SON; Henry 1960: Guaymas, SON; Henry and McLaughlin 1975: Topolobampo Bay and Mazatlán, SIN; Pilsbry 1916: Concepción Bay, BCS); Central Mexican Pacific (Henry and McLaughlin 1975: Puerto Vallarta, JAL; Pilsbry 1916: Manzanillo, COL). Southern Mexican Pacific (Henry 1941: Acapulco, GRO; Henry and McLaughlin 1975: Tangolunda, OAX; Gamboa-Contreras and Tapia-García 1998: Gulf of Tehuantepec, OAX); Central American Pacific (Pilsbry 1916: Panama; Henry and McLaughlin 1975: Costa Rica; Panama, Ecuador, Perú; Lozano-Cortés and Londoño-Cruz 2013: Colombia)
Phylum Entoprocta		
Barentsia discreta (Busk, 1886) *	INT	Southern California, Ecuador and Perú (Osburn 1953)
Phylum Bryozoa		
Bugula neritina (Linnaeus, 1758) *	INT	Southern California (Robertson 1905; Osburn 1950; Cohen et al. 2005); Gulf of California (Osburn 1950; Medina-Rosas and Tovar-Hernández 2012); Southern Mexican Pacific (Salcedo-Martínez et al. 1988: Zihuatanejo, GRO); Centro American Pacific (Hastings 1930: Panama and Galapagos)
Savignyella lafontii (Audouin, 1826) *	INT	Western coast of Baja California (Hara 2015); Centro American Pacific (Hastings 1930: Panama and Galapagos); Ecuador (Hara 2015)
Smittina sp.	Unk	This work
Phylum Chordata		
Ascidia ceratodes (Huntsman, 1912)	Nat	Southern California (Huntsman 1912; Van Name 1945, Lambert and Lambert 1998); Gulf of California (Van Name 1945); Southern Mexican Pacific (Moreno-Dávila 2010: Oaxaca); Centro American Pacific (Van Name 1945: Ecuador)
Botrylloides niger Herdman, 1886	INT	Gulf of California (Tovar-Hernández et al. 2022: Mazatlán and Teacapán, SIN, Guaymas and San Carlos, SON, La Paz, BCS; Sheets et al. 2016: Mazatlán, SIN); Southern Mexican Pacific (Moreno-Dávila 2010: Oaxaca); Galapagos (Lambert 2019)
Botrylloides violaceus Oka, 1927	INT	Western coast of Baja California (Lambert and Lambert 2003; Rodríguez and Ibarra-Obando 2008); Gulf of California (Carballo 2006: Topolobampo and Mazatlán, SIN; Tovar-Hernández et al. 2014: Topolobampo, SIN, Guaymas, SON and La Paz, BCS); Southern Mexican Pacific (Moreno-Dávila 2010: Oaxaca)
Diplosoma listerianum (Milne-Edwards, 1841)	INT	Southern California (Ritter and Forsyth 1917, Van Name 1945); Southern Mexican Pacific (Moreno-Dávila 2010: Oaxaca); Galapagos (Lambert 2019)
Styela cf. *canopus*	Unk	This work
Symplegma brakenhielmi (Michaelsen, 1904)	INT	Southern Mexican Pacific (Moreno-Dávila 2010: Oaxaca); Galapagos (Lambert 2019)

The polychaete Maldanidae NI (Figure 4A) was identified only to family level due to it being an incomplete specimen, making further identification difficult. The shell of the gastropod mollusk Calyptraeidae NI (Figure 6I) was damaged during extraction, causing it to lose diagnostic morphological features. Another five taxa were left at genus level: a sponge, *Cliona* sp. (Figure 2F, G), three polychaetes *Dipolydora* sp. (Figure 5A, B), *Polydora* sp. (Figure 5C, D), and *Streblosoma* sp. (Figure 5E, F), and a bryozoan, *Smittina* sp. (Figure 8E). These were not able to be identified to species level due to the lack of diagnostic morphological features.

Two taxa still need confirmation, *Parasabella* cf. *lacunosa* and *Styela* cf. *canopus*, since these have morphological differences pointed out in the remarks of each species.

Phylum Cnidaria Hatschek, 1888
Class Hydrozoa Owen, 1843
Order Anthoathecata Cornelius, 2000
Family Pennariidae McCrady, 1859

Pennaria disticha Goldfuss, 1820

Figure 3A–C

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 colony, UMAR-HYDR-013.

Identification. Erects colony, 6.8 cm high, from a creeping hydrorhiza. Monosiphonic hydrocaulus, alternately branched with terminal hydrants. Dark brown hydrocaulus, thick, straight, becoming slightly curved in upper section closest to the tip, with annulations where the branches arise. Branches more slender than the hydrocaulus with annulations along its entire length, younger branches without cancellations; hydrants distributed along the branch, about five hydrants per branch (Figure 3A). Pear-shaped hydrants, hypostome

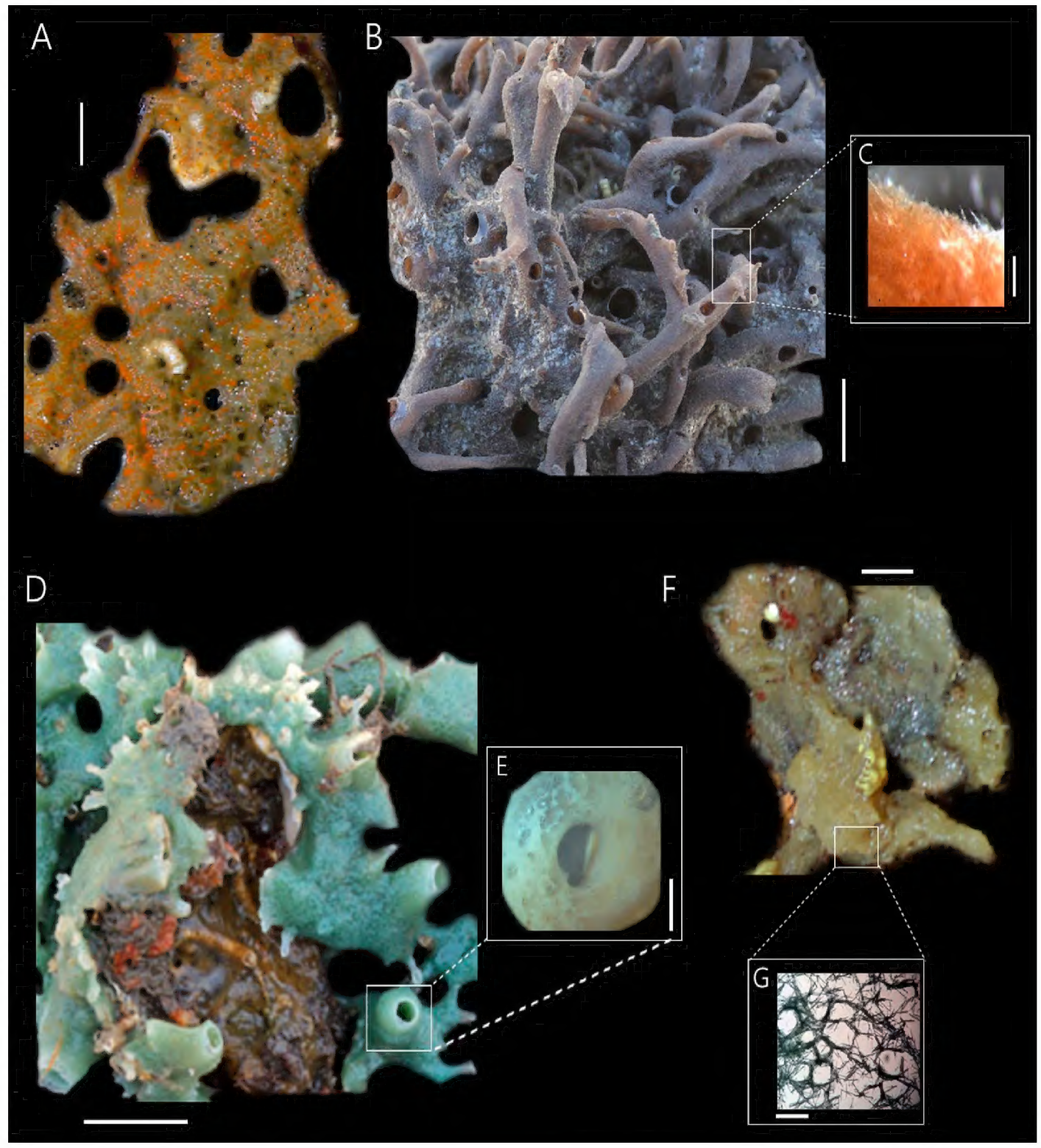

Figure 2. Sponges. **A, B, D, F.** Sponge, life coloration. **A.** Demospongiae NI 1. **B.** Demospongiae NI 2, whole specimen. **C.** Demospongiae NI 2, sponge surface detail. **D.** Demospongiae NI 3, whole specimen. **E.** Demospongiae NI 3, osculum detail. **F.** *Cliona* sp., whole specimen. **G.** *Cliona* sp., skeletal architecture detail. Scale bars: A, B, D = 1 cm; C, F = 0.5 mm; E = 2 mm; G = 100 µm.

surrounded by capitate tentacles, below some filiform tentacles (Figure 3B). Oval gonophores with four small bulbous projections (Figure 3C).

Distribution. Circum-(sub)tropical (Calder 2021). Eastern Pacific (Fraser 1938a, 1938b; Humara-Gil and Cruz-Gómez 2018; Calder 2021).

Remarks. *Pennaria disticha* was described from the Gulf of Naples, Italy (Goldfuss 1820). Fraser (1938a, 1938b) recorded *P. disticha* as *P. tiarella* (Ayres, 1854) at several locations in the Eastern Pacific. Humara-Gil and Cruz-Gómez (2018), provided the first record of *P. disticha* from Oaxaca, describing variations from the redescription of Schuchert (2006), regarding the number of tentacles and position and number of annulations in the pedicel. These variations were also observed in the Chahué Marina colony. Miglietta et al. (2015, 2018), after molecular analyzes, concluded that *P. disticha* is a species complex, with several species morphologically indistinguishable from each other.

Family Bougainvillidae Lütken, 1850

***Bougainvillia muscus* (Allman, 1863)**
Figure 3D, E

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 6 colonies, UMAR-HYDR-014 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 11 colonies, UMAR-HYDR-015 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 10 colonies, UMAR-HYDR-016.

Identification (UMAR-HYDR-014). Colony with erect stems, 17 mm high, monosiphonic branched, springing at intervals from a creeping stolon, and reaching short branches (Figure 3D). Tubular stolons, perisarc with detritus; terminal hydranth on branchlets light brown, with 7–13 filiform tentacles, varied in extension, hypostome rounded (Figure 3E).

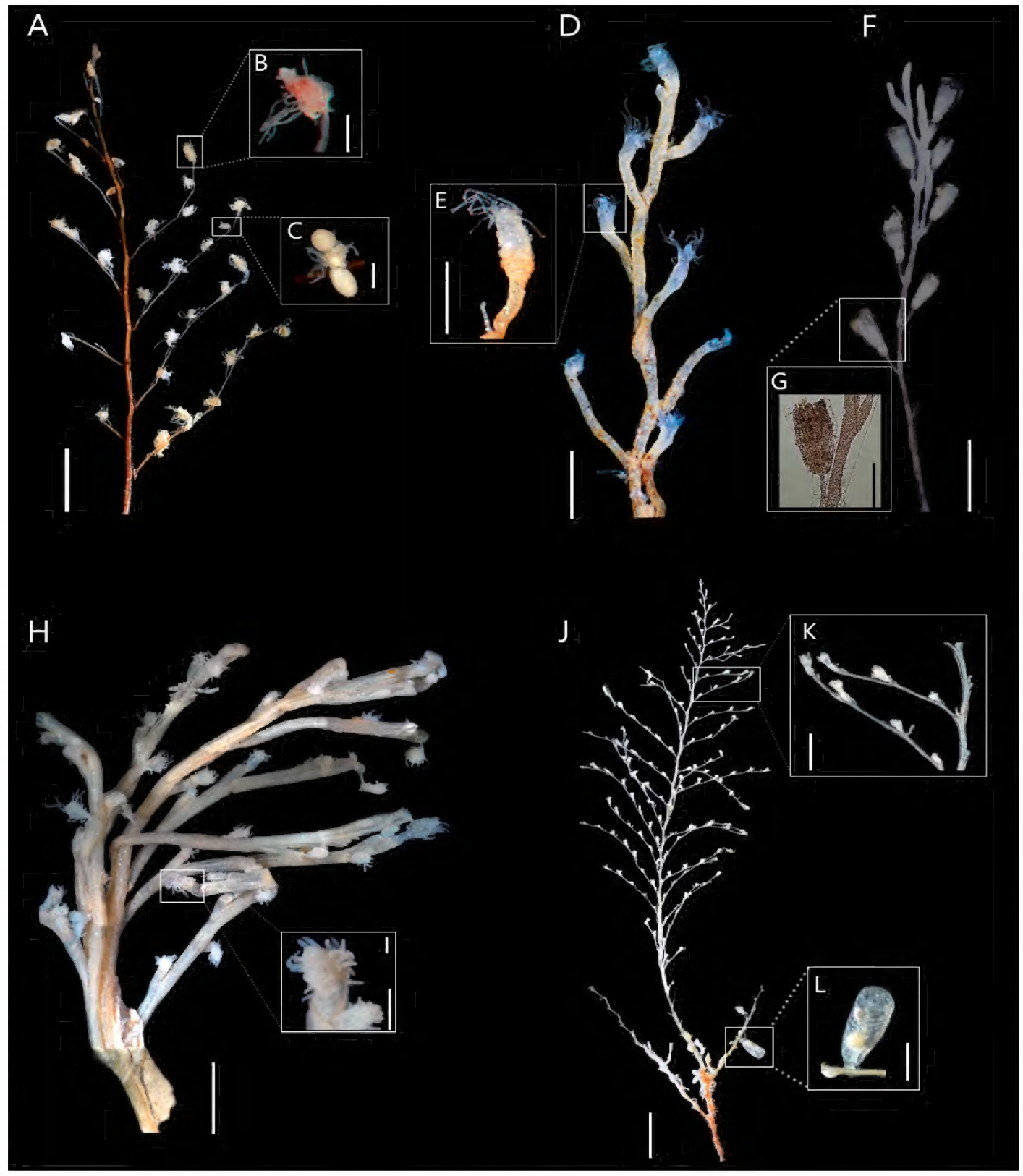

Figure 3. Hydrozoans. *Pennaria disticha*: **A.** Colony. **B.** Hydranth, detail. **C.** Hydranth with a mature gonophore, detail. *Bougainvillia muscus*: **D.** Colony. E) Hydranth, detail. *Obelia oxydentata*: **F.** Colony. **G.** Hydranth, detail. *Corydendrium flabellatum*: **H.** Colony. **I.** Hydranth, detail. *Ventromma halecioides*: **J.** Colony. **K.** Hydrocladium with terminal hydranth, detail. **L.** Gonotheca, detail. Scale bars: A, J= 3 mm; B–C, E, I, K–L= 0.5 mm; D, F= 1 mm; H= 2.5 mm; G= 250 µm.

Distribution. Western and Eastern Pacific, Atlantic and Indian Oceans (Calder 1988; Schuchert 2007; Calder 2010). This constitutes the first record of *Bougainvillia muscus* for Oaxaca as an introduced species.

Remarks. Although the type locality of *Bougainvillia muscus* is in Great Britain (Allman 1863), it has been recorded from the Pacific and Indian Oceans. Calder et al. (2019) recorded the species from the Galapagos Islands and stated that the species is part of the fouling community in ports and canals, possibly transported by navigation.

Family Oceaniidae Eschscholtz, 1829

***Corydendrium flabellatum* Fraser, 1938**
Figure 3H, I

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 colony, UMAR-HYDR-017.

Identification. Colony coarse, fascicled, approximately 2 cm high; main stem base 0.5 mm in diameter, irregularly branched, branches more slender than the main stem (Figure 3H). Perisarc tube firm, covering up to hydranth base; terminal hydranth, is elongate and cylindrical, with 17–20 scattered filiform tentacles on its surface (Figure 3I).

Distribution. Pacific of Panama and Mexico (east of Navidad and Isabel Islands, and Tenacatita Bay) (Calder et al. 2022). This constitutes the first record of *Corydendrium flabellatum* for Oaxaca.

Remarks. *Corydendrium flabellatum* was described from the Pacific of Panama (Fraser 1938a) and is the only *Corydendrium* species recorded in the Tropical Eastern Pacific. *Corydendrium flabellatum* is morphologically close to *C. parasiticum* (Linnaeus, 1767), and since Fraser (1938a) did not describe the gonophores in the original description, morphological differentiation between these two species is unclear. Although the colonies here examined also lack the gonophores, we identified them as *C. flabellatum*, which is an endemic species from Tropical Eastern Pacific, geographically distant from the distribution of *C. parasiticum* (Mediterranean Sea). The lack of knowledge of gonophores, however, reinforces the need for further studies to better distinguish these species. In this work, the local name will be retained until morphological and molecular analyzes are carried out between *C. flabellatum* and *C. parasiticum* as suggested by Calder et al. (2022).

Order Leptothecata Cornelius, 1992
Family Campanulariidae Johnston, 1836

***Obelia oxydentata* Stechow, 1914.**
Figure 3F, G

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies, UMAR-HYDR-018• same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 10 colonies, UMAR-HYDR-019 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-HYDR-020.

Identification (UMAR-HYDR-018). Erect colonies, 6.2 mm high, sympodial; derived from a creeping hydrorhiza. Without branching. Hydrocaulus with 8–10 well-defined annulations (Figure 3F). Short pedicels, along the pedicel with 3–5 well-defined annulations proximal to the hydrotheca. Bell-shaped hydrotheca, up to 500 µm high. Hydrotecal margin with 7–10 well-marked cusps with blunt tips (Figure 3G).

Distribution. Western Atlantic; Western and Eastern Pacific (Calder et al. 2019). This constitutes the first record of *Obelia oxydentata* for the Mexican Pacific and for Oaxaca as an introduced species.

Remarks. *Obelia oxydentata* was described from Saint Thomas, Lesser Antilles (Stechow 1914). The colonies found in Chahué Marina are morphologically close to *Obelia bidentata* Clark, 1875, described from Long Island, New York (Clark 1875). It should be noted that according to Calder et al. (2019), *O. bidentata* is represented by robust, tall colonies, about 15 cm tall, with polysiphonic stems; in comparison with the Chahué Marina specimens, which are smaller, less than 3 cm tall, and have monosiphonic stems and with shorter stolon, even than Stechow's (1914) *O. oxydentata* description.

Recently, Calder et al. (2019) recorded *Obelia oxydentata* from the Galapagos Islands, as an epibiont of *Amathia verticillata* (delle Chiaje, 1822) and as a common species in the fouling community on float docks.

Family Kirchenpaueriidae Stechow, 1921

***Ventromma halecioides* (Alder, 1859)**
Figure 3J–L

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 colonies, UMAR-HYDR-021 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies, UMAR-HYDR-022.

Identification (UMAR-HYDR-022). Pinnate colonies, 35 mm high, with creeping hydrorhiza (Figure 3J). Polysiphonic hydrocaulus, stem divided into internodes, with a distal hydrotheca and one nematotheca in the internode. Cup-shaped hydrotheca, smooth margin, hydranths larger than hydrotheca, dome-shaped hypostome, and about 14 filiform tentacles (Figure 3K). Barrel-shaped gonotheca, annulated, arising from hydrocaulus by a short pedicel (Figure 3L).

Distribution. Circum-(sub)tropical (Calder et al. 2021). Non-native species from Mexican Pacific coast (Fraser 1948; Humara-Gil and Cruz-Gómez 2018).

Remarks. *Ventromma halecioides* was described from Cullercoats, Northumberland, United Kingdom (Alder 1859). The colonies from Chahué Marina coincide morphologically with the original description of the species (Alder 1859), and the records from Oaxaca (Humara-Gil and Cruz-Gómez 2018) and Ecuador (Calder et al. 2021).

Phylum Annelida Lamarck, 1809
Class Polychaeta Grube, 1850
Family Sabellidae Latreille, 1825

***Branchiomma bairdi* (McIntosh, 1885)**
Figure 4B

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 58 specs., UMAR-POLY-991 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 25 specs., UMAR-POLY-992 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 98 specs., UMAR-POLY-993 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 383 specs., UMAR-POLY-994.

Identification (UMAR-POLY-993). Tubes flexible, brownish to dark, with horizontal dark brown to gray stripes. Body olive-green with small brown and white spots. Body length 38 mm long (Figure 4B). Radiolar crown with 10–16 pairs of radioles, with a pattern of white and brown transversal bands, with orange spots, macrostylodes strap-like. Collar lobes subtriangular with rounded ends.

Distribution. Circum-(sub)tropical. Western and Eastern Atlantic (Tovar-Hernández and Knight-Jones 2006; Çinar 2009; Ramalhosa et al. 2014), Western Pacific (Capa and Murray 2015), Central Pacific: Hawaii (Keppel et al. 2018), and Eastern Pacific: Southern California (Keppel et al. 2018), Gulf of California (Tovar-Hernández et al. 2009a, 2014, Bastida-Zavala et al. 2016), Manzanillo, Colima (Galván-Villa et al. 2023); Oaxaca (Bastida-Zavala et al. 2016), Panama (Capa and López 2004), and Galapagos Islands (del Pasqua et al. 2018, Keppel et al. 2019). The Caribbean Sea and Gulf of Mexico is their native range; in other regions it is considered non-native and/or invasive (Tovar-Hernández et al. 2009a, 2009b; Tovar-Hernández and Yáñez-Rivera 2012; Villalobos-Guerrero et al. 2012; Ramalhosa et al. 2014; Bastida-Zavala et al. 2016).

Remarks. *Branchiomma bairdi* was described from Bermuda by McIntosh (1885), with a native distribution including the Caribbean Sea and Gulf of Mexico (Tovar-Hernández and Knight-Jones 2006). Confirmed as an invasive species in the Mexican Pacific (Tovar-Hernández and Yáñez-Rivera 2012; Bastida-Zavala et al. 2016). Also, in some marinas and ports of Baja California Peninsula, placement of man-made substrata in perturbed sites has facilitated the introduction of the species to new sites (Bastida-Zavala et al. 2014).

Parasabella* cf. *lacunosa
Nominal species: *Parasabella lacunosa* (Perkins, 1984): 317–321, figs. 18–20; type locality: Hutchinson Island, Florida.
Figure 4C

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 58 specs., UMAR-POLY-995 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 specs., UMAR-POLY-996 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 135 specs., UMAR-POLY-997 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 69 specs., UMAR-POLY-998.

Identification (UMAR-POLY-997). Pale yellow body. Spiral radiolar crown, pink to reddish (Figure 4C), radioles lacks subdistal compound eyes and stylodes. Short subtriangular collar. Thoracic notochaetae spatulate, without mucron. Abdominal neurochaetae limbate. Thorax and abdominal uncini avicular with short manubrium, shorter than the distance between the crest and the chest; with companion neurochaetae with needle shape distal membrane. Lacks interramal abdominal eyespots.

Distribution. Only known from Chahué Marina.

Remarks. The specimens from Chahué Marina are morphologically close to *Parasabella lacunosa*, described from the Western Atlantic (Perkins 1984). The nominal species has not been recorded from any location near to the study area and, precautionarily, the specimens have been left as an unidentified species pending future comparisons with specimens of *P. lacunosa* from the Western Tropical Atlantic.

Family Serpulidae Rafinesque, 1815

***Hydroides brachyacantha* Rioja, 1941**
Figure 4D

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 specs., UMAR-POLY-999 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 9 specs., UMAR-POLY-1000.

Identification (UMAR-POLY-999). Tube white. Opercular peduncle smooth, whitish. Opercular funnel with 32 pointed tipped radii; verticil with eight spines strongly curved inwards, dorsal spine large occupying most of the central vertical; basal internal spinule in all spines (Figure 4D). Collar with bayonet chaetae, with two basal teeth pointed.

Distribution. Tropical Eastern Pacific. Gulf of California (Bastida-Zavala 2008; Tovar-Hernández et al. 2009b; Bastida-Zavala et al. 2016; Sun et al. 2016), Central Mexican Pacific (Rioja 1960; Morales de Anda et al. 2013; Bastida-Zavala et al. 2016; Yáñez-Rivera et al. 2020; Galván-Villa et al. 2023), Southern Mexican Pacific (Bastida-Zavala 2008; Bastida-Zavala et al. 2016), Central American Pacific (López-García et al. 1997; Bastida-Zavala and ten Hove 2003).

Remarks. *Hydroides brachyacantha* was described with specimens from Mazatlán, Sinaloa and Acapulco, Guerrero (Rioja 1941). Sun et al. (2016), revised *H. brachyacantha* records and molecular analyses comparing with the populations of *H. amri* Sun, Wong, ten Hove, Hutchings, Williamson & Kupriyanova, 2015 from Australia, and designated a neotype to *H. brachyacantha* in Mazatlán. The Chahué Marina specimens match morphologically with the nominal species description. This species is considered native from the region, further, this serpulid is very common in natural and man-made substrates along the Mexican Pacific (Bastida-Zavala et al. 2016).

***Hydroides dirampha* Mörch, 1863**
Figure 4E

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 specs., UMAR-POLY-1001.

Identification. Tube white with visible longitudinal and transverse ridges. Opercular peduncle white and smooth. Opercular funnel with 25–27 radii with pointed tips, verticil with 11–14 spines, straight, flattened T-shaped tip, with one basal internal spinule (Figure 4E). Collar with bayonet chaetae, with two basal teeth pointed.

Distribution. Circumtropical. Mediterranean, Gulf of Mexico, Caribbean Sea and Brazil (Zibrowius 1970, 1971; Bastida-Zavala and ten Hove 2002), South Africa (Day 1967), India (Lakshmana Rao 1969), Hong Kong (Sun et al. 2012), Australia (Sun et al. 2015), New Zealand (Mörch 1863), Philippines, South of Japan, Marshall Islands (Imajima 1978), Hawaii (Bailey-Brock et al. 2012), California. Tropical Eastern Pacific: Gulf of California (Rioja 1941a; Bastida-Zavala 1993; Bastida-Zavala and ten Hove 2003; Bastida-Zavala 2008; Tovar-Hernández et al. 2014; Bastida-Zavala et al. 2016); Southern Mexican Pacific (Rodríguez-Valencia 2004; Bastida-Zavala et al. 2016); Panama (Nelson-Smith 1967).

Remarks. *Hydroides dirampha* was described from St. Thomas Island, Lesser Antilles (Mörch 1863) and recorded elsewhere, mainly on anthropogenic substrates in warm and temperate waters (Bastida-Zavala et al. 2016). Although it was considered a cryptogenic species (Okolodkov et al. 2007), other authors (Zibrowius 1992; Ben-Eliahu and ten Hove 2011) speculate that the origin of *H. dirampha* probably is the tropical Eastern Atlantic. This is a confirmed non-indigenous species from the Mexican Pacific, and it could be found often associated with ports and marinas in the region (Bastida-Zavala et al. 2016).

***Hydroides elegans* (Haswell, 1883)**
Figure 4F

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 spec., UMAR-POLY-1002.

Identification. Tube white, without longitudinal ridges. White and smooth opercular peduncle. Opercular funnel with 24 radii with blunt tips, verticil with 14–16 spines, all spines similar in shape and size with pointed tips; all the spines with three pairs of lateral spinules (Figure 4F). Collar with bayonet chaetae, with several tiny teeth.

Distribution. Circumtropical. North Sea (Monro 1938; Gee 1963; ten Hove 1974), Mediterranean and Red Sea (Zibrowius 1971; ten Hove 1974; Çinar 2005, Ben-Eliahu and ten Hove 2011), Gulf of Mexico, Caribbean Sea, Brazil and Argentina (Zibrowius 1970; ten Hove 1974; Bastida-Zavala and ten Hove 2002; Schwan et al. 2015), Western and Eastern Africa (Zibrowius 1971, 1973; ten Hove 1974), South Africa (Day 1967), Persian Gulf and Gulf of Oman (Pazoki et al. 2023), Arabian Sea (Ishaq and Mustaquim 1996), India (Lakshmana Rao 1969), Sri Lanka (Pillai 1960; ten Hove 1974), Hong Kong (Sun et al. 2012), Philippines (Pillai 1965), Australia (Sun et al. 2015), Japan (Imajima 1976), Micronesia (Imajima 1977, 1982), California and Hawaii (Zibrowius 1971; Bailey-Brock 1987; Bastida-Zavala and ten Hove 2003), Western coast of Baja California (Díaz-Castañeda and Valenzuela-Solano 2009). Tropical Eastern Pacific: Gulf of California (Bastida-Zavala

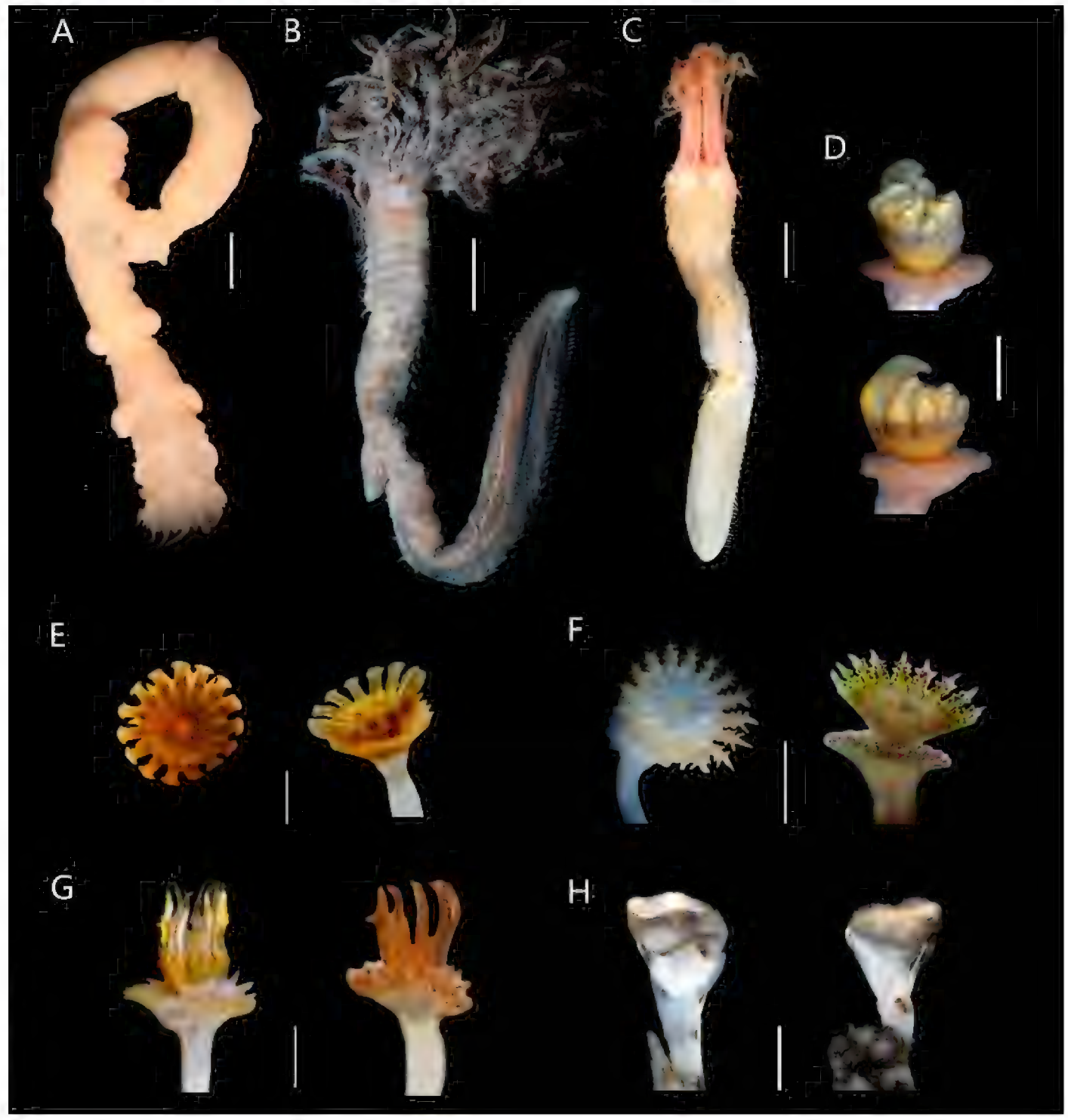

Figure 4. Polychaetes. **A.** Maldanidae NI **B.** *Branchiomma bairdi*. **C.** *Parasabella* cf. *lacunosa*. **D–J.** Serpulidae opercula. **D.** *Hydroides brachyacantha*. **E.** *H. dirampha*. **F.** *H. elegans*. **G.** *H. sanctaecrucis*. **H.** *Spirobranchus minutus*. Scale bars: A = 1 mm; B = 4 mm; C = 1.5 mm; D–H = 0.5 mm.

2008; Tovar-Hernández et al. 2009b, 2014; Bastida-Zavala et al. 2016), Central Mexican Pacific (Galván-Villa et al. 2023), Southern Mexican Pacific (Rodríguez-Valencia 2004; Bastida-Zavala et al. 2016), Galapagos (Keppel et al. 2019).

Remarks. *Hydroides elegans* was described from Port Jackson, Australia (Haswell 1883) and recorded elsewhere, commonly at ports and marinas on anthropogenic substrata in warm and temperate waters (Tovar-Hernández et al. 2009b; Bastida-Zavala et al. 2016). This is a confirmed non-native species in the Mexican Pacific (BastidaZavala et al. 2016).

***Hydroides sanctaecrucis* Krøyer in: Mörch, 1863**
Figure 4G

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 273 specs., UMAR-POLY-1003 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 89 specs., UMAR-POLY-1004 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 398 specs., UMAR-POLY-1005 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1005 specs., UMAR-POLY-1006.

Identification (UMAR-POLY-1003). Tube with two ill-defined ribs. Opercular peduncle smooth and white. Opercular funnel with 22–24 radii with pointed tips, white color base, and yellowish tip; verticil with 12–14 spines, pointed tips, dorsal spines curving inwards, ventral ones curving outwards (Figure 4G). All spines with an external spinule, with wings slightly extending. Collar with bayonet chaetae, with two basal teeth pointed.

Distribution. Circumtropical. Caribbean Sea, French Guiana, Gulf of Mexico, east coast of the United States (Fauvel 1919; Rioja 1958; Zibrowius 1971; Day 1973; Bastida-Zavala and ten Hove 2002; Bastida-Zavala et al. 2017), Hong Kong (Sun et al. 2012), Australia (Lewis et al. 2006; Sun et al. 2015), Hawaii (Long 1974). Tropical Eastern Pacific: Gulf of California (Tovar-Hernández et al. 2012, 2014; Bastida-Zavala et al. 2016), Southern

Mexican Pacific (Bastida-Zavala and ten Hove 2002; Bastida-Zavala 2008; Bastida-Zavala et al. 2016), Central American Pacific (Bastida-Zavala and ten Hove 2002), Galapagos (Keppel et al. 2019). The Caribbean Sea and Gulf of Mexico is their native range; in the rest regions is considered as a non-indigenous and/or invasive species (Tovar-Hernández et al. 2014; Bastida-Zavala et al. 2016, 2017).

Remarks. *Hydroides sanctaecrucis* was described from Saint Croix Island, Lesser Antilles (Mörch 1863). It was the most abundant species in this study, whose presence could be of concern in the natural habitat, because this species competes successfully for substrate with other native species. Bastida-Zavala and ten Hove (2002, 2003) mentioned that the species could be transported by maritime means.

***Spirobranchus minutus* (Rioja, 1941)**
Figure 4H

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 spec., UMAR--POLY-1008 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 specs., UMAR-POLY-1009 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 6 specs., UMAR--POLY-1010 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 15 specs., UMAR-POLY-1011.

Identification (UMAR-POLY-1008). Tube white, with three longitudinal ridges and two rows of alveoli along the tube; transversally circular. Branchial crown with two semicircular lobes. Opercular peduncle insert in the left lobe, with short and smooth wings, with pointed tips, opercular plate with a mid-dorsal slight depression. Operculum conical, smooth, with a pair of lateral circular dark spots, in the mid operculum (Figure 4H). Few collar chaetae limbate.

Distribution. Tropical Eastern Pacific and Western Tropical Atlantic. From Gulf of Mexico (Rioja 1946; Bastida-Zavala and Salazar-Vallejo 2000; Bastida-Zavala et al. 2017), Venezuela (Weisbord 1964), Brazil (Zibrowius 1970), Hawaii (Bastida-Zavala 2008) and Australia (Lewis et al. 2006). Tropical Eastern Pacific: Gulf of California (Rioja 1942, 1947, Berkeley and Berkeley 1958; Rioja 1963; Bastida-Zavala 1993, 1995, 2008), Central Mexican Pacific (Bastida-Zavala et al. 2016; Yáñez-Rivera et al. 2020; Galván-Villa et al. 2023), Southern Mexican Pacific (Rioja 1941b, 1963; Bastida-Zavala 2008; Bastida-Zavala et al. 2016), Central American Pacific (Bastida-Zavala 2008).

Remarks. *Spirobranchus minutus* was described from Acapulco, Guerrero (Rioja 1941b). The specimens revised from Chahué Marina match with the description by Rioja (1941b). Bastida-Zavala et al. (2016) recorded the species on rocks from Chahué Marina and mentioned that the species could colonize both natural and artificial substrates, as was found in this study.

Phylum Sipuncula Sedgwick, 1898
Family Phascolosomatidae Stephen & Edmonds, 1972

***Phascolosoma puntarenae* Grube, 1858**
Figure 5G, H

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 spec., UMAR-SIPU-160.

Identification. Body light brown, covered with scattered dome-shaped papillae, darker than the body (Figure 5G). With digitiform nuchal tentacles. Unidentate hooks arranged in rings (Figure 5H). With four retractor muscles.

Distribution. Tropical Eastern Pacific. From Gulf of California to Panama (Silva-Morales and Gómez-Vásquez 2021).

Remarks. *Phascolosoma puntarenae* was described from Puntarenas, Costa Rica (Grube 1858). Despite the juvenile condition of the specimen, the diagnostic morphological characters of *Phascolosoma puntarenae* were observed, mainly the arrangement and conformation of the introvert hooks and the presence of the dome-shaped papillae. According to Cutler (1994), all sipunculan species live exclusively in marine waters, never in brackish waters. Thus, this is the first record of a sipunculan in brackish waters (salinity 27) from the Tropical Eastern Pacific.

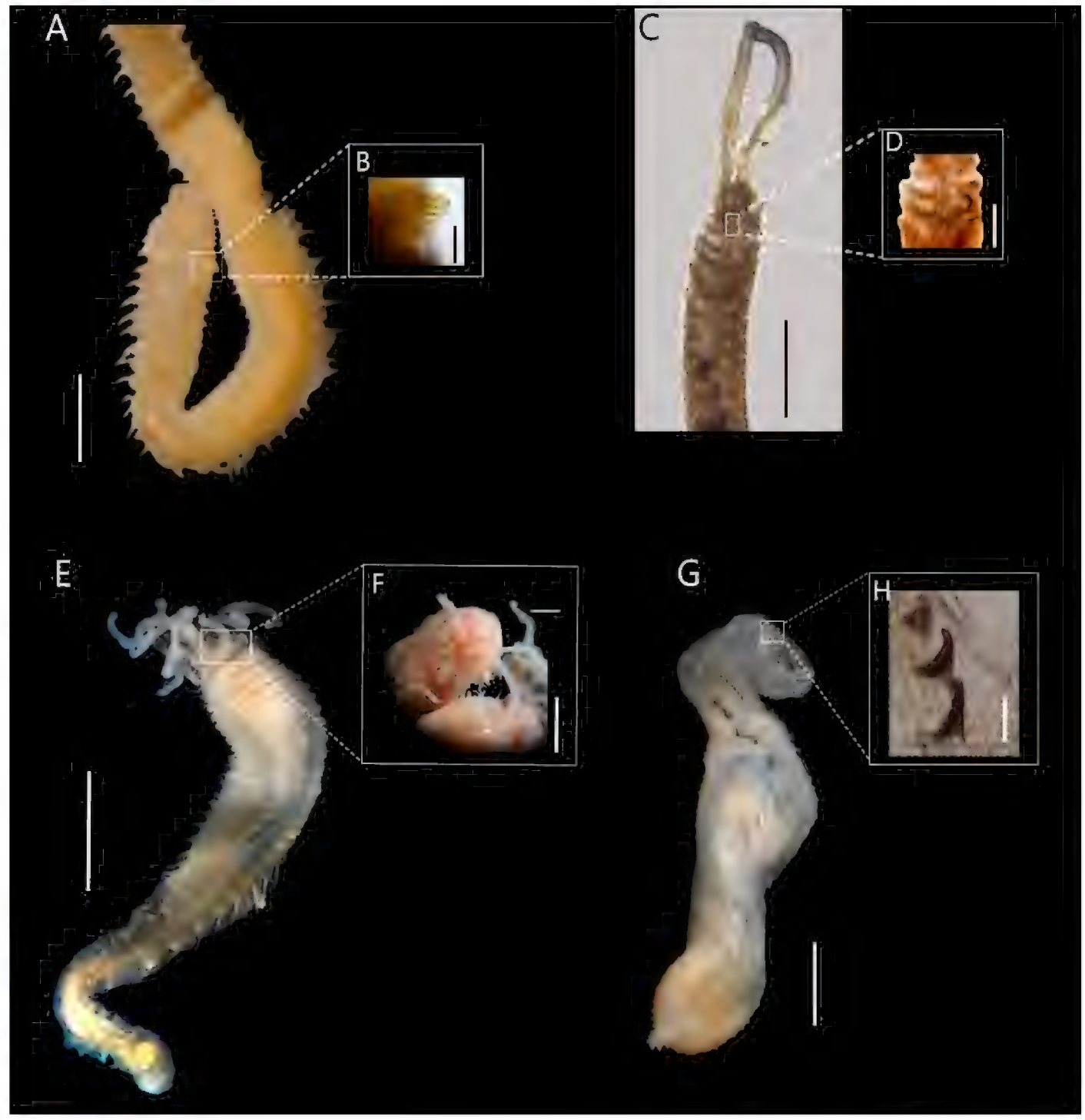

Figure 5. Polychaetes and sipunculan: *Dipolydora* sp.: **A.** Body. **B.** 15th chaetiger, detail. *Polydora* sp.: **C.** Body. **D.** Nuchal antennae, detail. *Streblosoma* sp.: **E.** Body. **F.** Anterior section, detail. *Phascolosoma* (*Phascolosoma*) *puntarenae*: **G.** Body. **H.** Hooks, detail. Scale bars: A, C, F–G = 1 mm; B = 100 µm; D = 300 µm; E = 2 mm; H = 100 µm.

Phylum Mollusca Linnaeus, 1758
Class Bivalvia Linnaeus, 1758
Family Mytilidae Rafinesque, 1815

***Leiosolenus aristatus* (Dillwyn, 1817)**
Figure 6A

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 specs., UMAR-BIVA-020 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 23 specs., UMAR-BIVA-021.

Identification (UMAR-BIVA-021). Size 14.2 mm. Shell elongated cylindrical, of pale-yellow color with lighter parts, sharp towards the anterior end with rounded termination and the tips between crossed (Figure 6A). With terminal calcareous adhesions. Line pattern on the shell is visible.

Distribution. Western Atlantic (Turgeon et al. 2009), Eastern Pacific (Cantera and Contreras 1988), and Western Africa (Holguín-Quiñones and González-Pedraza 1989).

Remarks. *Leiosolenus aristatus* was described from Senegal, Western Africa (Dillwyn 1817). According to the description of Olsson (1961), the specimens have an average length of 32 mm, larger than the Chahué Marina specimens (6–14 mm). However, the termination of the leaflets in long and rounded tips that alternately intersect, resembling a pair of scissors, is diagnostic, even in the smaller specimens, differing only in the prolongation of the tips.

Family Ostreidae Rafinesque, 1815

***Ostrea conchaphila* Carpenter, 1857**
Figure 6B

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N,

Figure 6. Mollusks: **A.** *Leiosolenus aristatus*. **B.** *Ostrea conchaphila*. **C.** Bivalvia NI 2. **D.** *Saccostrea palmula*. **E.** *Striostrea prismatica*. **F.** Bivalvia NI 1. **G.** *Thylacodes margaritaceus*. **H.** *Thylaeodus indentatus*. **I.** Calyptraeidae NI **J.** *Crucibulum spinosum*. Scale bars: A, B, D, E, H–J = 3 mm; C = 250 µm; F = 1 mm; G = 5 mm.

096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 33 specs., UMAR-BIVA-022 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 112 specs., UMAR-BIVA-023 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 63 specs., UMAR-BIVA-024 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 669 specs., UMAR-BIVA-025.

Identification (UMAR-BIVA-025). Size 1.6 cm on average (n= 15). Shell dorsoventrally elongated; upper valve slightly flattened. Outer margin slightly wavy. Short and triangular ligament. Internal color white with brown to light green spots. Exterior color light brown with darker bands on the surface (Figure 6B).

Distribution. Eastern Pacific (Lodeiros et al. 2020). From Oregon to San Diego, Mexico, and Panama (Carpenter 1857).

Remarks. *Ostrea conchaphila* was described from Mazatlán, Sinaloa (Carpenter 1857). The specimens from Chahué Marina match with the original description of Carpenter (1857). This native species was previously recorded by Holguín-Quiñones and González-Pedraza (1989) who mentioned it as a common sessile species in artificial substrates.

Saccostrea palmula **(Carpenter, 1857)**
Figure 6D

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096° 07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 specs., UMAR-BIVA-026.

Identification. Size 1.7 cm on average (n= 15). Shell oval, longer than wide. Slightly pronounced cup-shaped lower valve, upper valve slightly flattened. Outer margin with palmate foliations. Internal color from white to

yellowish green, and for the row of denticles. Olive green exterior color with laminar growth (Figure 6D).

Distribution. Tropical Eastern Pacific. From western coast of Baja California Sur, Gulf of California to Perú (Holguín-Quiñones and González-Pedraza 1989; Lodeiros et al. 2020).

Remarks. *Saccostrea palmula* was described from Mazatlán, Sinaloa, as a subspecies of *Ostrea conchaphila* (Carpenter 1857), posteriorly moved to *Saccostrea* Dollfus & Dautzenberg, 1920 by Harry (1985). The specimens match morphologically with the original description (Carpenter 1857).

***Striostrea prismatica* (Gray, 1825)**
Figure 6E

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 spec., UMAR-BIVA-027 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 specs., UMAR-BIVA-028 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 17 specs., UMAR-BIVA-029.

Identification (UMAR-BIVA-029). Size 1.9 cm. Shell irregularly oval. Flat upper valve. A small recess present under the frequently enlarged ligament area of the left leaflet. Heavily marked, widely spaced chomatas, with five on each side of the ligament area. Dark brown outer surface, strongly iridescent whitish inner surface (Figure 6E).

Distribution. Tropical Eastern Pacific. From southern Gulf of California to Perú (Lodeiros et al. 2020).

Remarks. *Striostrea prismatica* is a native oyster from Tropical Eastern Pacific. The studied specimens share the diagnostic characteristics described by Carpenter (1864).

Class Gastropoda Cuvier, 1795
Family Calyptraeidae Lamarck, 1809

***Crucibulum spinosum* (G.B. Sowerby I, 1824)**
Figure 6J

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 spec., UMAR-GAST-013.

Identification. Size 2 cm. Shell oval. High apex curved and inclined to one side. Oblique spines arranged in generally regular rows, some tubular spines, especially those of greater length. White shell with gray, brown and reddish tones. Crenulated margin. Slender cup-shaped structure on the ventral part of the shell (Figure 6J).

Distribution. Eastern Pacific. From California to Chile (Hendrickx et al. 2014; Aguilar-Estrada et al. 2017).

Remarks. *Crucibulum spinosum* is a native species of spiny cup-and-saucer snail from the Eastern Pacific (Hendrickx et al. 2014). Although the specimens examined here were smaller than the specimens recorded by Keen (1971), they share the diagnostic characters. However, the specimens differ in having lesser definition in the distribution and size of the shell spines.

Family Vermetidae Rafinesque, 1815

***Thylacodes margaritaceus* (Rousseau in Chenu, 1844)**
Figure 6G

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 5 spec., UMAR-GAST-010.

Identification. Size 2.7 cm. Shell tubular sinuous. The upper part of the shell is light brown with darker patches, and the lower part white, circular opening. Ornate surface with fine lines along the tube (Figure 6G). Inner tube porcelain.

Distribution. Mexican Pacific (Brusca 1980; Gamboa-Contreras and Tapia-García 1998; González-Villarreal 2005).

Remarks. *Thylacodes margaritaceus* is a vermetid endemic to the Mexican Pacific (Brusca 1980). According to Keen (1971), this species has almost straight tubes and is often ornamented by lines along the tube, as was observed in the specimens examined here; however, the ends are slightly curved (Figure 6G).

***Thylaeodus indentatus* (Carpenter, 1857)**
Figure 6H

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 spec., UMAR-GAST-011.

Identification. Size 2 cm. Tubular shell, with a very marked spiral in the shape of a tower. Black color with red parts; circular opening. Ornate surface with fine lines along the tube (Figure 6H). Inner tube porcelain.

Distribution. Mexican Pacific (Carpenter 1857; Keen 1961; Brusca 1980; Rodríguez-Palacios et al. 1988).

Remarks. *Thylaeodus indentatus* was described from Mazatlán, Sinaloa (Carpenter 1857) and endemic to the Mexican Pacific (Brusca 1980; Rodríguez-Palacios et al. 1988). Keen (1961) mentioned that this species exhibit color variations, including the reddish coloration, which can be slightly seen on the edges of the tubular shells (Figure 6H).

Phylum Arthropoda von Siebold, 1848
Subphylum Crustacea Brünnich, 1772
Class Maxillopoda Dahl, 1956
Order Sessilia Lamarck, 1818
Family Balanidae Leach, 1817
Subfamily Amphibalaninae Pitombo, 2004

***Amphibalanus amphitrite* (Darwin, 1854)**
Figure 7A–E

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1,597 spec., UMAR-THOR-032 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 spec., UMAR--THOR-033 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1,054 spec., UMAR-THOR-034 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 92 spec., UMAR-THOR-035.

Identification (UMAR-THOR-032). Shell with smooth white plates, with violet-pink or dark to violet-colored longitudinal stripes (Figure 7A). Scutum, internal region slightly concave in the middle part (Figure 7B). Tergum with a slight carinal protrusion and a spur wide as long, rounded (Figure 7C). Labrum multidentate, with 10 teeth on each side decreasing in size, pronounced notch in the middle part (Figure 7E). Mandible with four to six teeth, two upper and four lower, fourth and sixth teeth with additional denticles (Figure 7D).

Distribution. Circum-(sub)tropical. South Africa, Mediterranean, Black Sea, Atlantic, Pacific and Indian oceans, including Hawaii, Australia and Japan (Henry and MacLaughlin 1975). Eastern Pacific: Gulf of California (Henry and McLaughlin 1975; Salgado-Barragán and Hendrickx 2002; Gómez-Daglio and González 2006), Southern Mexican Pacific (Henry and McLaughlin 1975; Gamboa-Contreras and Tapia-García 1998), and Panama (Spivey 1976).

Remarks. *Balanus amphitrite* was described by Darwin (1854) from Natal, South Africa (*sensu* Harding 1962). Posteriorly, the *B. amphitrite* complex was revised by Henry and MacLaughlin (1975), who confirmed the wide distribution in tropical and subtropical waters. Twenty years ago, Pitombo (2004) performed a phylogenetic analysis of the Balanidae, establishing a new subfamily, the Amphibalaninae, and a new genus *Amphibalanus* Pitombo, 2004, whose type species is *B. amphitrite*.

The specimens of *Amphibalanus amphitrite* from Chahué Marina match the description of Darwin (1854) and the redescription by Harding (1962), with some differences regarding the labrum, it was supposed to have 4–13 teeth (Darwin 1854; Harding 1962), whereas the Chahué Marina specimens have 8–18 teeth (Figure 7E); the mandible in the Chahué Marina specimens has three upper teeth and two lower teeth, the last with an irregular shape (Figure 7D), whereas Darwin (1854) and Harding (1962) described it with two upper teeth and three lower teeth, all with an irregular shape. However, these variations fall in the variation range of the redescription of *A. amphitrite* made by Henry and MacLaughlin (1975).

***Amphibalanus eburneus* (Gould, 1841)**
Figure 7F–J

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2,351 spec., UMAR-THOR-036 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 9 spec., UMAR-THOR-037 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1,040 spec., UMAR-THOR-038 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 322 spec., UMAR-THOR-039.

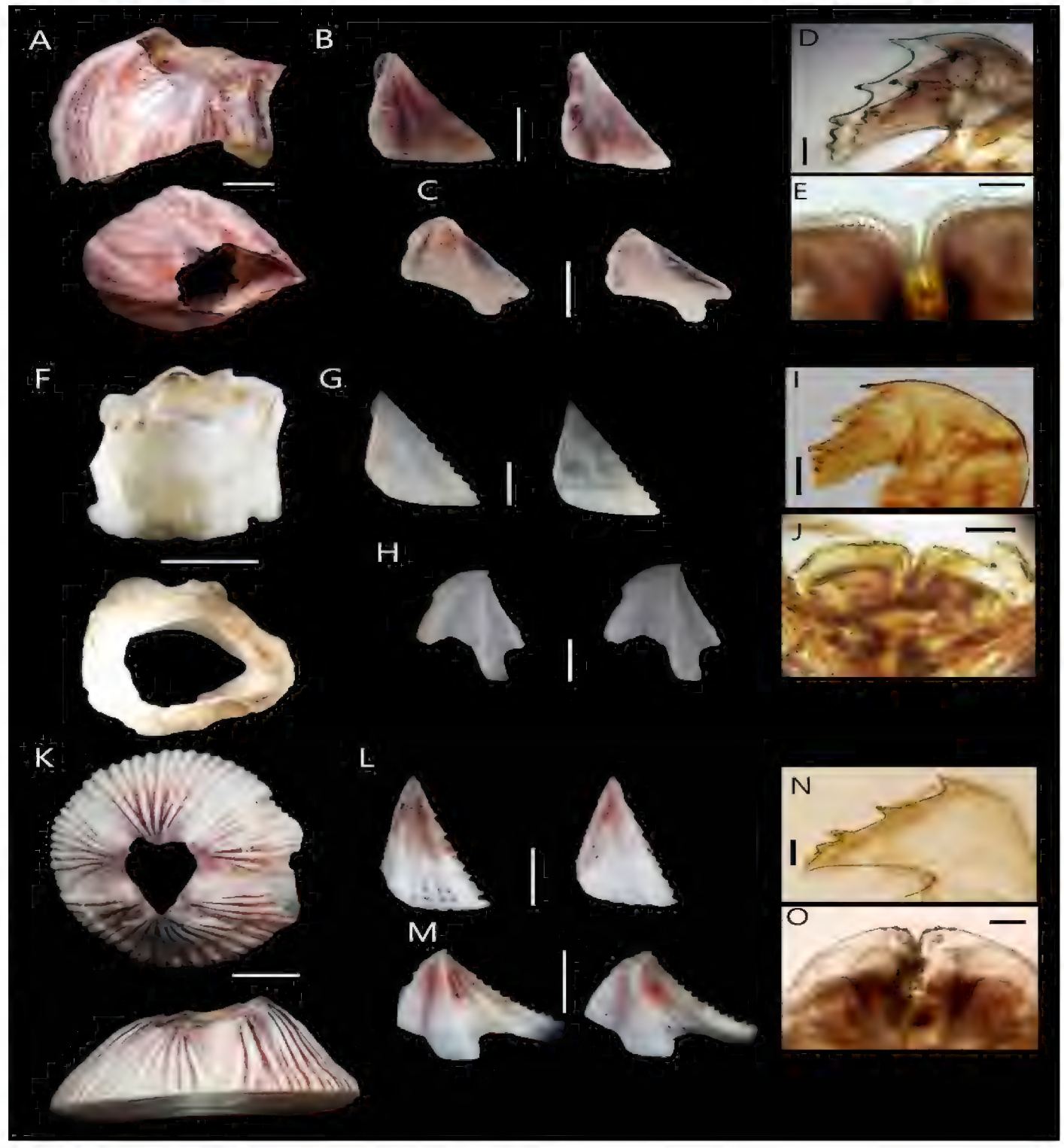

Figure 7. Crustaceans: *Amphibalanus amphitrite*: **A.** Shell. **B.** External and internal views of scutum. **C.** external and internal views of tergum. **D.** Mandible. **E.** Labrum. *Amphibalanus eburneus*: **F.** Shell. **G.** External and internal views of scutum. **H.** External and internal views of tergum. **I.** Mandible. **J.** Labrum. *Balanus trigonus*: **K.** Shell. **L.** External and internal views of scutum. **M.** External and internal views of tergum. **N.** Mandible. **O.** Labrum. Scale bars: A = 1.5 mm; B–C, G–H, L–M = 2 mm; D, I–J = 200 µm; E = 75 µm; F = 5 mm; K= 3 mm; N–O = 100 µm.

Identification (UMAR-THOR-036). White shell conical with smooth ivory white plates (Figure 7F). The scutum has strongly marked growth ridges and teeth at the occlusal margin (Figure 7G). The tergum has a protruding carinal margin and does not have a marked longitudinal groove (Figure 7H). Labrum with 11 teeth on each side, the central part presents a pronounced notch (Figure 7J). Mandible with six teeth, two upper teeth, and four lower teeth; fourth, fifth, and sixth of irregular shape (Figure 7I).

Distribution. Circum-(sub)tropical. East coast of the United States to Brazil, southwest Europe, Mediterranean, Black and Caspian seas, Western Africa, India, Japan to Hawaii and Eastern Pacific (Henry and MacLaughlin 1975). Eastern Pacific: Gulf of California (Henry and McLaughlin 1975; Salgado-Barragán and Hendrickx 2002), Colima (Henry and McLaughlin 1975), Panama (Matsui et al. 1964) and Colombia (Lozano-Cortés and Londoño-Cruz 2013). This constitutes the first record of *Amphibalanus eburneus* for Oaxaca as a non-native species.

Remarks. *Balanus eburneus* was described by Gould (1841) from Boston Bay, Massachusetts (*sensu* Henry and McLaughlin 1975). Recently, the species was moved to the genus *Amphibalanus* by Pitombo (2004). The shells of the specimens of the Chahué Marina match morphologically with the redescription provided by Henry and McLaughlin (1975); and some characters reflects the juvenile stage of the specimens studied: The labrum in Chahué Marina specimens has 11 teeth (Figure 7J), while Henry and McLaughlin (1975) mentions 6–32 teeth; the mandible of the examined specimens had six teeth (Figure 7I), while the redescription of Henry and McLaughlin (1975) mention that it has 5–7 teeth. Additionally, the first maxilla of Chahué Marina specimens has 10 spines, while the redescription mention that it has 5–14 spines (Henry and McLaughlin 1975).

Subfamily Balaninae Leach, 1817

***Balanus trigonus* Darwin, 1854**
Figure 7K–O

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 5 spec., UMAR-THOR-030 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 68 spec., UMAR-THOR-031.

Identification (UMAR-THOR-030). Shell conical, triangular opening almost equilateral; walls with a pattern of vertical violet-pink lines (Figure 7K). Radii with a white background color, sometimes showing pale pink patches. Scutum is slightly internally concave in the middle part; an ivory white external region with pale pink patches, longitudinal grooves with four rows of deep perforations, more widely spaced at the base of the shield; margin occlude jagged (Figure7L). Tergum wider than long and spur as long as wide and short; straight basal margin; pronounced basi-scudal angle (Figure 7M).

Labrum with three small teeth, notorious notch in the middle (Figure 7O). Mandible with five teeth, fourth and fifth smaller with additional denticles and irregular tip (Figure 7N).

Distribution. Circum-(sub)tropical. Indian, Pacific, and Atlantic oceans: Japan, Australia, New Zealand, Red Sea, Southern California, Perú, Caribbean Sea to Southern Brazil, Madeira and Azores to South Africa (Pilsbry 1916). Eastern Pacific: Western coast of Baja California Sur (Pilsbry 1916; Henry and McLaughlin 1975), Gulf of California (Pilsbry 1916; Henry 1943, 1960; Henry and McLaughlin 1975), Jalisco and Colima (Pilsbry 1916; Henry and McLaughlin 1975), Guerrero (Henry 1941), Oaxaca (Henry and McLaughlin 1975; Gamboa-Contreras and Tapia-García 1998), Costa Rica, Panama, Colombia, Ecuador, Perú (Pilsbry 1916; Henry and McLaughlin 1975; Lozano-Cortés and Londoño-Cruz 2013).

Remarks. *Balanus trigonus* was described from Java, Indonesia by Darwin (1854). The specimens collected from Chahué Marina match the original description provided by Darwin (1854) and the redescription by Pilsbry (1916). However, these specimens exhibit a deep internal curvature in the scutum and tergum that is not mentioned in either Darwin's original description or Pilsbry's redescription.

Phylum Entoprocta Nitsche, 1890
Family Barentsiidae Emschermann, 1972

***Barentsia discreta* (Busk, 1886)**
Figure 8A, B

Material examined. MEXICO/ Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 colony, UMAR-ENTO-001 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies, UMAR-ENTO-002 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-ENTO-003 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 8 colonies, UMAR-ENTO-004.

Identification (UMAR-ENTO-001). Stolon progressive and thin, with some bifurcations. Basal muscle slightly long, up to ¼ as long as the stem length; slightly transparent and compressible in consistency, inverted elongated cup-shaped. Slender straight peduncle, slightly widening upwards, with perforations in the inner layer; joints not present (Figure 8A). Calyx vase-shaped, terminal lophophore; calyx base separated from the pedicel by a short flexible portion. Lophophore with 12 to 20 filiform tentacles, according to the zooids size (Figure 8B).

Distribution. Circum-(sub)tropical. Western Atlantic, Japan, India (Osburn 1953). Eastern Pacific: Southern California, Ecuador, Perú and Magallanes Strait (Osburn 1953; Wasson and Mariscal 2007). This constitutes the first record of *Barentsia discreta* for the Mexican Pacific and for Oaxaca as a non-native species. It is also the first entoproct recorded for Oaxaca.

Remarks. *Barentsia discreta* was described from Nightingale Island, in the Southern Atlantic Ocean (Busk 1886). The colonies from Chahué Marine morphologically match with the description; however, the zooids have fewer tentacles (12–20) and joints have not been observed, whereas Osburn (1953) recorded 20–24 tentacles and joints may occasionally occur.

Barentsia discreta has a worldwide distribution in both natural and artificial substrates. Owing to its physiological tolerance to environmental conditions, it is considered a non-native species in the Eastern Pacific (Osburn 1953; Emschermann 1993). In this work *B. discreta* is considered as non-native species of the Tropical Eastern Pacific.

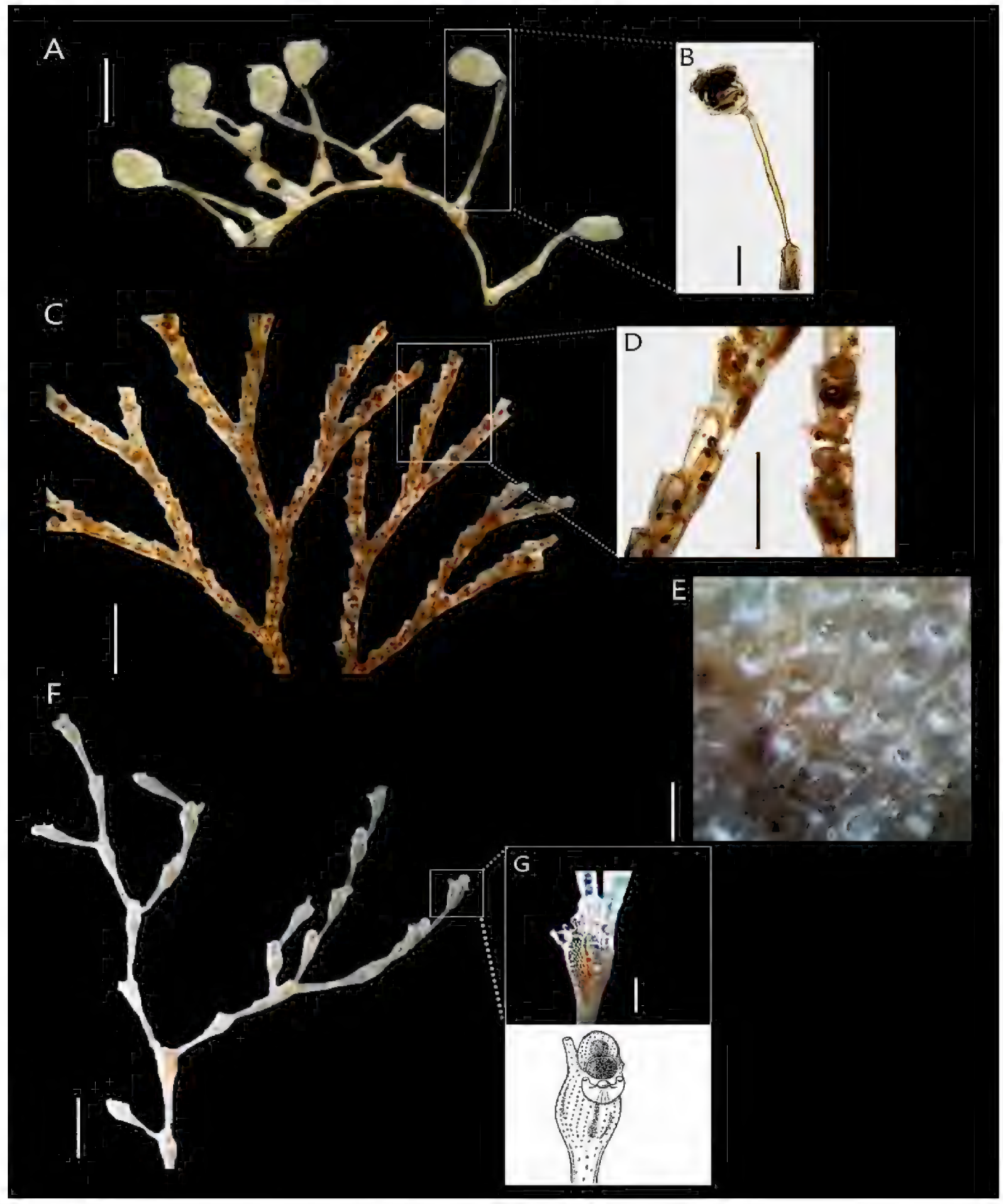

Figure 8. Entoproct and bryozoans: *Barentsia discreta*: **A.** Colony. **B.** Zooid. *Bugula neritina*: **C.** Colony. **D.** Zooid. **E.** *Smittina* sp. *Savignyella lafontii*: **F.** Colony. **G.** Zooid. Scale bars: A, D, F = 1 mm; B = 100 µm; C = 3 mm; E = 0.5 mm; G = 250 µm.

Phylum Bryozoa Nitsche, 1869
Class Gymnolaemata Allman, 1856
Order Cheilostomatida Busk, 1852
Family Bugulidae Gray, 1848

***Bugula neritina* (Linnaeus, 1758)**
Figure 8C, D

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR--BRYO-005 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 8 colonies, UMAR-BRYO-006.

Identification. Branches erect in a bushy form, with color ranging from reddish-purple to light brown. Branching is dichotomous, with zooids in two alternating rows. Zooids oval, 200–300 µm in length, with a single pointed tip on the outer corner of the zooids; avicularia and spines absent (Figure 8C). Ovicells large, globular with a brittle consistency; white to dark brown in color, located in the middle of the branches in vertical rows (Figure 8D).

Distribution. Circum-(sub)tropical. Western Atlantic (Marcus 1937; Osburn 1940) and Eastern Europe (Ryland 1960). Eastern Pacific: Southern California (Robertson 1905; Osburn 1950; Cohen et al. 2005), Gulf of California (Osburn 1950; Medina-Rosas and Tovar-Hernández 2012), Guerrero (Salcedo-Martínez et al. 1988), Panama and Galapagos (Hastings 1930). Non-native species in the Eastern Pacific (Robertson 1905; Osburn 1950; Salcedo-Martínez et al. 1988). This constitutes the first record of *Bugula neritina* for Oaxaca as a non-native species.

Remarks. *Bugula neritina* was described from the Mediterranean Sea by Linnaeus (1758). The colonies from Chahué Marina match with the redescriptions of Osburn (1940) and Ryland (1960). Nevertheless, molecular studies (e.g. Davidson and Haygood 1999; McGovern and Helberg 2003; Mackie et al. 2006) on this species have noted that it could be a cryptic species even if the morphological resemblance is consistent (Medina-Rosas and Tovar-Hernández 2012). In this work, *B. neritina* is considered as non-native species to the Tropical Eastern Pacific, meanwhile, its identity in the Eastern Pacific remains unclear.

Family Savignyellidae Levinsen, 1909

***Savignyella lafontii* (Audouin, 1826)**
Figure 8F, G

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1 colony, UMAR-BRYO-007.

Identification. Erect colony, fragile, uniseriate growth, joints between nodes formed by a single zooid; stolon with variable length; color *in vivo* light brown, preserved in alcohol translucent (Figure 8F). Zooids elongate, surface covered with pores, oral opening oval, 4–6 non-articulated spines (Figure 8G). Avicularia of irregular shape. Ovicell rounded, with pores on the surface.

Distribution. Circumtropical. Egypt, Western Atlantic, Western Africa, Australia (Marcus 1937; Osburn 1952; Winston 1982), Atlantic of Spain, Mediterranean Sea, Red Sea, East Africa, Persic Gulf, India, Indonesia and Micronesia (Hara 2015). Eastern Pacific: Western coast of Baja California (Hara 2015), Panama, Galapagos and Ecuador (Hastings 1930; Hara 2015). This constitutes the first record of *Savignyella lafontii* for the Tropical Mexican Pacific and for Oaxaca as a non-native species.

Remarks. *Savignyella lafontii* was described from Egypt (Audouin 1826). The colony matches the redescription of Winston (1982). The species shows a disjunct distribution in the Eastern Pacific, which is more related to inconsistent sampling effort, rather than the natural distribution. It is likely that, by increasing the sampling effort along the Eastern Pacific, the real distribution of the species would be clear, and reveal the continuous distribution of this species. In this work, *S. lafontii* is considered a non-native species in the Tropical Eastern Pacific.

Phylum Chordata Haeckel, 1874
Class Ascidiacea Blainville, 1824
Order Aplousobranchia Lahille, 1886
Family Didemnidae Giard, 1872

***Diplosoma listerianum* (Milne-Edwards, 1841)**
Figure 9A, B

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 colonies, UMAR-ASCI-070 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 colonies, UMAR-ASCI-071 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 9 colonies, UMAR-ASCI-072 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 colonies, UMAR-ASCI-073.

Identification (UMAR-ASCI-070). Colonial. Transparent, soft test with embedded zooids. Zooids brown, grayish or black colored, oral siphon, and abdomen variable, some even have a yellow hue on the thorax (Figure 9A). Atrial siphon lateral to pharynx, runs along it. Male gonad divided in two. Pharynx with two to four rows, each with 7–10 stigmas. Organs in the abdominal region.

Larvae oval, embedded in the tunic. Three adhesive papillae in a row, with a thin peduncle. With four pairs of ectodermal suction cups on each side. The tail extends over the middle of the body (Figure 9B).

Distribution. Cosmopolitan, in cold, temperate and tropical waters. Eastern Pacific: Southern California (Ritter and Forsyth 1917; Van Name 1945), Oaxaca (Moreno-Dávila 2010) and Galapagos (Lambert 2019).

Remarks. *Diplosoma listerianum* was described from the La Manche coast, France (Milne-Edwards 1841). The colonies examined from Chahué Marina match with the original description. Ritter and Forsyth (1917) and Van Name (1945) recorded this species from Southern California (as *D. pizoni). Diplosoma listerianum* was first recorded from Oaxaca coast by Moreno-Dávila (2010). It is a non-native species in the Western Atlantic and Eastern Pacific (Van Name 1945).

Order Phlebobranchia Lahille, 1886
Family Ascidiidae Herdman, 1880

***Ascidia ceratodes* (Huntsman, 1912)**
Figure 9E

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 spec., UMAR--ASCI-074 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 219 spec., UMAR-ASCI-075 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 67 spec., UMAR-ASCI-076.

Identification (UMAR-ASCI-075). Tunic beige, ovoid-shaped and flattened. Muscles visible through skin. Oral siphon with eight lobes, atrial siphon with six lobes; both with pale orange spot between each lobe (Figure 9E). Nerve ganglion at the base of the atrial siphon. With 100–120 tentacles of two sizes, filiform. Dorsal tubercle U-shaped with a rolled edge towards the center; in the center of the dorsal lamina. Symmetrical pharynx with 30–40 longitudinal vessels, 70–75 transverse vessels, and 3–4 stigmata, dome-shaped papillae. Digestive tract occupies more than half of the left side of the body, and has a narrow intestinal loop, stomach globose. One portion of the ovary is surrounded by the first intestinal loop and the other portion is on the second intestinal loop. Male follicles are in the stomach and the first intestinal loop.

Distribution. Eastern Pacific. Southern California (Huntsman 1912; Van Name 1945; Lambert and Lambert 1998, 2003), Gulf of California (Van Name 1945), Oaxaca (Moreno-Dávila 2010), Ecuador (Van Name 1945) and Chile (Cañete et al. 2019).

Remarks. *Ascidia ceratodes* was described from Departure Bay, Southwestern Canada (Huntsman 1912). The specimens examined match with the redescription of Van Name (1945); it has been observed that Chahué Marina has fewer tentacles and fewer longitudinal vessels than the Van Name (1945) redescription (100–120, 30–40 versus 150–200, 30–45, respectively). *Ascidia ceratodes* was first recorded from the Oaxaca coast by Moreno-Dávila (2010).

Order Stolidobranchia Lahille, 1886
Family Styelidae Sluiter, 1895

***Botrylloides niger* Herdman, 1886**
Figure 9C, D

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies, UMAR-ASCI-077 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-ASCI-078 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-ASCI-079.

Identification (UMAR-ASCI-078). Colony form a thin mat, test dark colored on the periphery, with soft consistency. Zooids grouped in long and sinuous orange systems. Shallow common cloacal apertures (Figure 9C). After being fixed, the colony shows a purple-brown color. Zooids with a length of 1–1.9 mm. Tubular oral siphon; both siphons without lobes. Pharynx with 9–11 rows of stigmata. Straight stigmata. Stomach ovoid with folds, intestinal loop short and close to the ventral base of the zooid (Figure 9D). Gonads in the upper part of the intestine, circular ovary.

Distribution. Circumtropical. Tropical Western Atlantic (Van Name 1921; Rocha and Bonnet 2009), Gulf of Suez, Eastern Africa, Malaysia, Australia (Van Name 1945), French Polynesia (Monniot and Monniot 1987) and Micronesia (Monniot and Monniot 2001). Tropical Eastern Pacific: Gulf of California (Sheets et al. 2016; Tovar-Hernández et al. 2022), Oaxaca (Moreno-Dávila 2010) and Galapagos (Lambert 2019).

Remarks. *Botrylloides niger* was described from Bermuda (Herdman 1886). The specimens examined here match with the original description. The stomach in zooids examined presented 7–9 folds, which may be the result of incomplete folds, being lesser number of folds compared with the ones recorded by Van Name (1921), nine mains with one or two small incomplete folds. *Botrylloides niger* was first recorded from Oaxaca by Moreno-Dávila (2010). Is a non-native species in the Tropical Eastern Pacific (Tovar-Hernández et al. 2022).

***Botrylloides violaceus* Oka, 1927**
Figure 9F, G

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies,

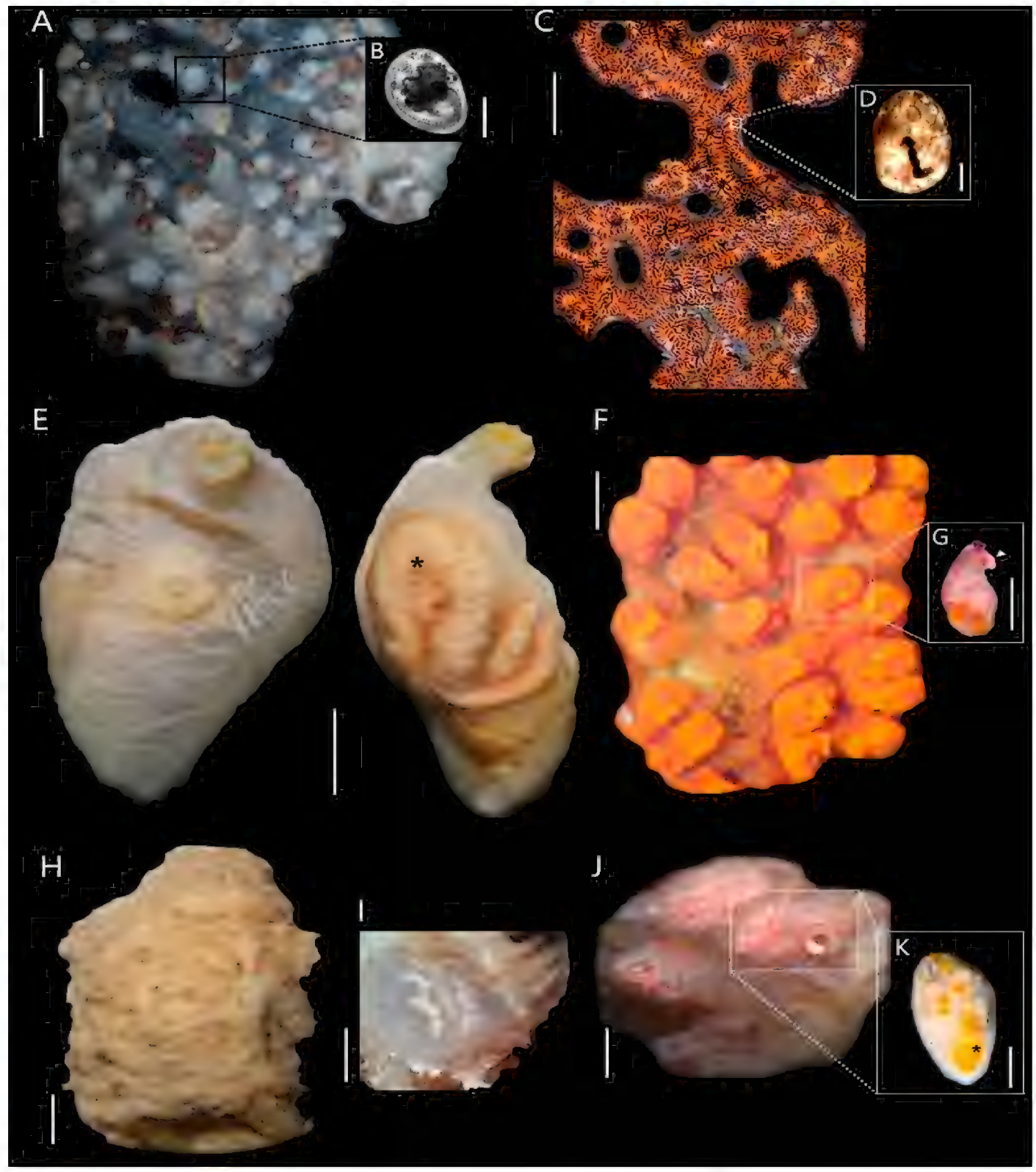

Figure 9. Ascidians: *Diplosoma listerianum*: **A.** Colony. **B.** Larvae. *Botrylloides niger*: **C.** Colony. **D.** Zooid. *Ascidia ceratodes*: **E.** Individual without tunic, asterisk indicates the firths intestine loop. *Botrylloides violaceus*: **F.** Colony. **G.** Zooid, triangle indicate the tongue. *Styela* cf. *canopus*: **H.** Individual. **I.** Gonads. *Symplegma brakenhielmi*: **J.** Colony. **K.** Zooid, asterisks indicate the stomach. Scale bars: A, K = 1 mm; B = 0.5 mm; C = 1 cm; D = 0.4 mm; E = 2.5 mm; F–G = 200 µm; H, I = 5 mm; J = 2 mm.

UMAR-ASCI-080 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-ASCI-081 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 8 colonies, UMAR-ASCI-082.

Identification (UMAR-ASCI-081). Colonies flat encrusting, in life of an intense orange coloration, siphons light brown; purple-brown colored once the colonies are fixed. Slim and soft test. Zooids completely embedded in the test. Shallow common cloacal apertures (Figure 9F). Round oral siphon, atrial siphon with wide opening and with atrial languet (Figure 9G). Pharynx without folds, 7–10 rows of stigmata. Gonads in the upper part of the intestinal loop, round ovaries, and testes with follicles.

Distribution. Circum-(sub)tropical. Japan and Micronesia (Tokioka 1967), Mediterranean Sea (Zaniolo et al. 1998), Spain (El Nagar et al. 2010). Tropical Eastern Pacific: Western coast of Baja California (Lambert and Lambert 2003; Rodríguez and Ibarra-Obando 2008), Gulf of California (Carballo 2006; Tovar-Hernández et al. 2014) and Oaxaca (Moreno-Dávila 2010).

Remarks. *Botrylloides violaceus* was described from Japan (Oka 1927). This species can be confused with *B. diegensis* Ritter and Forsyth, 1917; Tokioka (1953) mentioned that the easiest way to differentiate both species is the life coloration, *B. diegensis* is bicolor and *B. violaceus* presents a single color with different shades, which was observed in the Chahué Marina colonies. The observation of the atrial languet differs in length from that recorded by Tokioka (1953); however, this may be due to the fixation method, which did not include the relaxation of the organisms, so this structure is retracted. *Botrylloides violaceus* was first recorded from Oaxaca by Moreno-Dávila (2010). It is a non-native species in the Eastern Pacific (Tokioka 1967; Lambert and Lambert 2003).

Styela* cf. *canopus
Nominal species: *Styela canopus* (Savigny, 1816): 95–98; type locality: Strait of Magellan.
Figure 9H, I

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 45 spec., UMAR-ASCI-083 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 5 spec., UMAR-ASCI-084 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 1,550 spec., UMAR-ASCI-085 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 624 spec., UMAR-ASCI-086.

Identification (UMAR-ASCI-084). Flattened body, lacking regular shape. Tunic light brown, firm consistency. In the siphons the coloration intensifies *in vivo* with thin white bands (Figure 9H). Longitudinal muscles arise from the siphons.

Oral and atrial siphons found in the anterior part of the body, with short distance between them, of similar size, both tetralobulated. 22–30 simple gill tentacles of three sizes. Very narrow U-shaped orifice of the dorsal tubercle. Pharynx with four longitudinal folds on each side, longitudinal straight stigmata, 20–30 longitudinal vessels (approximately four between each fold) and parastigmatic vessels present. Continuous, smooth, and wavy dorsal lamina. Intestine on the left side of the pharynx. Stomach elongated, with the inner wall with 17–20 longitudinal folds. The anus has undulations. Hermaphroditic gonads, two on each side of the body. Gonad elongated; globular testes follicles surrounding female glands (Figure 9I).

Distribution. Chahué Marina, Oaxaca.

Remarks. The specimens of *Styela* cf. *canopus* from Chahué Marina are morphologically close to *S. canopus* (Savigny 1816); however, there are some differences, Chahué Marina specimens have 17–20 stomach folds, 22–30 tentacles and show a very narrow U-shaped dorsal tubercle, while *S. canopus* has 18–30 stomach folds, 40–50 tentacles and a wide U-shaped tubercle (Van Name 1945). De Barros and Rocha (2021) suspected that *S. canopus* is a complex of cryptic species and analyzed 19 populations, using simple locus methods, and concluded that the current *S. canopus* comprises at least 15 species. For the differences between the redescription of Van Name (1945) and the Chahué Marina specimens, and considering the discovery of de Barros and Rocha (2021), our specimens have precautionarily been left as an unidentified species pending future revision of *Styela* species from the Eastern Tropical Pacific.

Symplegma brakenhielmi (Michaelsen, 1904)
Figure 9J, K

Material examined. MEXICO/Tropical Eastern Pacific – Oaxaca • Huatulco, Chahué Marina; 15°45′49″N, 096°07′17″W; 1 m depth; 24.VIII.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 3 colonies, UMAR-ASCI-087 • same locality; 30.XI.2019; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 2 colonies, UMAR-ASCI-088 • same locality; 22.II.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 4 colonies, UMAR-ASCI-089 • same locality; 13.VI.2020; A. Ramos-Morales and J.D. Gómez-Vásquez leg.; 6 colonies, UMAR-ASCI-090.

Identification (UMAR-ASCI-088). Tunic translucent. Zooids transparent with orange or olive-green pigmented vessels observed in life, endostyle and siphons also pigmented (Figure 9J). Zooids oval and dorsoventrally flattened; 2.5 mm long and 1.5 mm wide. Both siphons located anteriorly. Pharynx, with four longitudinal vessels. Nine rows of stigmata, three stigmata between each vessel. Stomach oval located to the right of the pharynx, with 12–14 folds. Gonads on each side of the pharynx, female gonads between two sets of male gonads. Female gonads circular shaped. Male gonads branched joining at one end, of which five to six come out in each case (Figure 9K).

Distribution. Circum-(sub)tropical. Gulf of Mexico (Michaelsen 1904), Bermuda, East coast of United States, Caribbean Sea, Brazil, Western Africa (Monniot et al. 1991), Mediterranean Sea (Çinar et al. 2005; Shenkar and Loya 2009; Ulman et al. 2017; Rizgalla et al. 2019), Micronesia, New Caledonia (Monniot et al. 1991; Monniot and Monniot 2001), Southern California (Lambert and Lambert 1998). Tropical Eastern Pacific: Oaxaca (Moreno-Dávila 2010) and Galapagos (Lambert 2019).

Remarks. *Symplegma brakenhielmi* was described from Veracruz, Gulf of Mexico (Michaelsen 1904). The colonies have two colorations of the vessels, orange and olive-green, both were lost by fixation; also, the stomach have slightly fewer folds than those described by Michaelsen (1904) (12–14 versus 14-15), but both agree in the shape of the stomach (oval); however, Monniot and Monniot (1987) mentioned that the stomach has a rectangular shape. *Symplegma brakenhielmi* was first recorded from Oaxaca by Moreno-Dávila (2010). Is a non-native species in the Eastern Pacific (Lambert and Lambert 2003; Moreno-Dávila 2010).

Abundance. Concerning the abundance of solitary species (12,994 specimens in all samples), the phylum Arthropoda (6,541 specimens) constitutes 50.3% of all specimens, followed by the phylum Annelida (2,997

specimens, 23.1%), and Mollusca (943 specimens, 7.3%). These three phyla represent 80.7% of the total specimens. The most abundant species (8,233 specimens) were two barnacles, *Amphibalanus eburneus* (3,722 specimens, 28.6%), *A. amphitrite* (2,746 specimens, 21.1%), and one serpulid worm, *Hydroides sanctaecrucis* (1,765 specimens, 13.6%). These three species are all non-native.

Regarding the abundance of colonial species (146 colonies), colonial ascidians (57 colonies) constitute 39% of all colonies, followed by hydrozoans (50 colonies, 34.2%), and bryozoans (16 colonies, 11%). The most abundant colonial species (61 colonies) were two hydrozoans, *Bougainvillia muscus* (27 colonies, 18.5%), *Obelia oxydentata* (16 colonies, 11%), and one ascidia, *Diplosoma listerianum* (18 colonies, 12.3%). These three colonial species are all non-native.

DISCUSSION

Studies in ports, marinas, and estuarine ecosystems (e.g. Winston 1982; Coles et al. 1999; Salgado-Barragán et al. 2004; Çinar et al. 2005; Cohen et al. 2005; Çinar 2009; Shenkar and Loya 2009; Tovar-Hernández et al. 2009a; Bastida-Zavala and García-Madrigal 2012; Ramalhosa et al. 2014; Bastida-Zavala et al. 2017; Galván-Villa and Ríos-Jara 2018; Keppel et al. 2018, 2019; Calder et al. 2019, 2021, 2022; Humara-Gil and Cruz-Gómez 2019; Lambert 2019; Rizgalla et al. 2021; Tovar-Hernández et al. 2022; Bastida-Zavala et al. 2024), usually have the detection of introduced species as a main objective, however; few studies examine the diversity that is established in these areas. In the present study, 44 taxa of fouling invertebrates were reported (Table 1), which represents 2.5% of the 1,765 marine invertebrate species recorded from Oaxaca State from all types of substrates (Bastida-Zavala and García-Madrigal 2022).

Fouling is a cause for concern because it is the main conduit for the introduction of non-native species (Karslon and Osman 2012; Okolodkov and García-Escobar 2014). In our study, polychaetes and ascidians had the highest number of non-native species, each with four taxa, followed by barnacles with three species. The entoproct *Barentsia discreta* was recorded for the first time in the Mexican Pacific, although it is a common fouling organism in bays and ports of California, growing abundantly in sessile communities (Wasson and Mariscal 2007). Introduced species usually represent the highest abundance of organisms in fouling communities of ports and marinas, as was demonstrated in this study, where the three most abundant solitary species (8,233 specimens) represented 63.4% of all specimens, and the three most abundant colonial species (61 colonies) were 41.8% of all colonies. All six species are non-native.

The use of molecular techniques has generated new approaches to examine species that were previously considered non-native, but have since been determined as native or groups of non-distinguishable cryptic species, such as hydrozoans (Miglietta et al. 2018), barnacles (Chen et al. 2014; Kim et al. 2022), bryozoans (Davidson and Haygood 1999) and ascidians (Peréz-Portela et al. 2013; de Barros and Rocha 2021). These molecular tools, coupled with comprehensive morphological studies, could improve our knowledge and clarify the status of non-native species recorded in poorly studied coastal regions such as the Southern Pacific coast of Mexico.

Six species that we documented represent new records for the Southern Mexican Pacific and seven are new records for Oaxaca: one entoproct (*Barentsia discreta*), one barnacle (*Amphibalanus eburneus*), two bryozoans (*Bugula neritina* and *Savignyella lafontii*) and three hydrozoans (*Bougainvillia muscus*, *Coryndendrium flabellatum* and *Obelia oxydentata*).

This work provides a baseline that could generate interest to carry on monitoring activities of port-inhabiting fouling fauna in Oaxaca to ensure early detection of non-native species in this highly biodiverse region.

In addition to the lack of studies on marine fouling fauna in the Mexican Pacific many studies of fouling invertebrates (either ecological or taxonomic approaches) are mainly focused on the most abundant species or describing new species. In both cases, studies are mainly focused on the macrofauna, while the rare or smaller species are often overlooked. We suggest more studies looking at biofouling in coastal lagoons, rocky beaches, and coral reefs, along with permanent monitoring programs to detect non-native species in marinas, ports, and ballast waters using multitaxa approaches and molecular analyses.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: ARM, JRBZ. Data curation: ARM. Formal analysis: ARM. Funding acquisition: ARM, JDGV. Investigation: ARM, JDGV, MSGM, JRBZ. Methodology: ARM, JDGV, JRBZ. Resources: ARM, JDGV, MSGM, JRBZ. Supervision: ARM, JDGV, MSGM, JRBZ. Project administration: ARM. Software: ARM. Validation: ARM, JDGV, MSGM, JRBZ. Visualization: ARM. Writing – original draft: ARM, JDGV. Writing – review and editing: ARM, JDGV, MSGM, JRBZ.

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Data availability

All data that support the findings of this study are available in the main text.

REFERENCES

Aguilar-Estrada LG, Ruiz-Boijseauneau I, Rodríguez D (2017) Estadios juveniles de las especies de gasterópodos pateliformes y de poliplacóforos (Mollusca) asociados a macroalgas intermareales de Guerrero, México. Revista Mexicana de Biodiversidad 88 (2): 280–299. https://doi.org/10.1016/j.rmb.2017.03.021

Alder J (1859) Descriptions of three new species of sertularian zoophytes. Annals and Magazine of Natural History Series 3, 3: 353–356.

Allman GJ (1863) Notes on the Hydroida. I. On the structure of *Corymorpha nutans*. II. Diagnoses of new species of Tubularidae obtained, during the autumn of 1862, on the coasts of Shetland and Devonshire. Annals and Magazine of Natural History Series 3, 11: 1–12.

Audouin V (1826) Explication sommaire des Planches de l'Egypte et de la Syrie. In Description de l'Egypte, Historie Natural, Paris 4: 225–249.

Bailey-Brock JH (1987) Phylum Annelida. In: Devaney DM, Eldredge LG (Eds.) Reef and shore fauna of Hawaii. Section 3: Sipuncula through Annelida. Special Publication of the Bernice P. Bishop Museum 64: 213–453.

Bailey-Brock JH, Magalhães WF, Brock RC (2012) Coral reef inhabiting tubeworms (Polychaeta: Serpulidae) from Enewetak, Kwajalein, Rongelap and Utirik Atolls, Marshall Islands. Journal of the Marine Biological Association of the United Kingdom 92 (5): 967–988. https://doi.org/10.1017/s0025315411001950

Bastida-Zavala JR (1993) Taxonomía y composición biogeográfica de los poliquetos (Annelida: Polychaeta) de la bahía de La Paz, B.C.S., México. Revista de Investigaciones Científicas, UABCS 4 (1): 11–39.

Bastida-Zavala JR (1995) Poliquetos (Annelida: Polychaeta) del arrecife coralino de Cabo Pulmo-Los Frailes, B.C.S., México. Revista de Zoología, ENEPi, UNAM 6: 9–29.

Bastida-Zavala JR (2008) Serpulids (Annelida: Polychaeta) from the Eastern Pacific, including a brief mention of Hawaiian serpulids. Zootaxa 1722: 1–61. https://doi.org/10.11646/zootaxa.1722.1.1

Bastida-Zavala R, García-Madrigal S (2012) First record in the Tropical Eastern Pacific of the exotic species *Ficopomatus uschakovi* (Polychaeta, Serpulidae). ZooKeys 238: 45–55. https://doi.org/10.3897/zookeys.238.3970

Bastida-Zavala JR, García-Madrigal MS (2022) La biodiversidad de invertebrados marinos del Pacífico sur de México. In: Bastida-Zavala JR, García-Madrigal MS (Eds.) Invertebrados marinos y costeros del Pacífico sur de México. Universidad del Mar and Geomare, Puerto Ángel, Oaxaca, México, 1–20.

Bastida-Zavala JR, Salazar-Vallejo SI (2000) Serpúlidos (Polychaeta: Serpulidae) del Caribe noroccidental con claves para la región del Gran Caribe: *Salmacina*, *Ficopomatus*, *Pomatoceros*, *Pomatostegus*, *Protula*, *Pseudovermilia*, *Spirobranchus* y *Vermiliopsis*. Revista de Biología Tropical 48: 807–840. https://doi.org/10.15517/rbt.v48i4.18900

Bastida-Zavala JR, ten Hove HA (2002) Revision of *Hydroides* Gunnerus, 1768 (Polychaeta: Serpulidae) from the Western Atlantic Region. Beaufortia 52: 103–178.

Bastida-Zavala JR, ten Hove HA (2003) Revision of *Hydroides* Gunnerus, 1768 (Polychaeta: Serpulidae) from the Eastern Pacific Region and Hawaii. Beaufortia 53 (4): 67–110.

Bastida-Zavala JR, de León-González JA, Carballo JL, Moreno-Dávila B (2014) Invertebrados bénticos exóticos: Esponjas, poliquetos y ascidias. In: Mendoza R, Koleff P. (Eds.) Especies acuáticas invasoras en México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Ciudad de México, México, 317–336.

Bastida-Zavala JR, García-Madrigal MS, Pérez-Hernández BN, Ramírez-Hernández H, Galván-Villa CM (2024) Primer registro del coral copo de nieve, *Carijoa riisei* (Cnidaria: Anthozoa: Octocorallia) en una laguna costera del Pacífico sur de México. Ciencia y Mar 28 (83): 23–28. https://doi.org/10.59673/cym.v28i83.4

Bastida-Zavala JR, McCann LD, Keppel E, Ruiz GM (2017) The fouling serpulids (Polychaeta: Serpulidae) from United States coastal waters: An overview. European Journal of Taxonomy 344: 1–76. https://doi.org/10.5852/ejt.2017.344

Bastida-Zavala JR, Rodríguez AS, de León-González JA, Camacho-Cruz KA, Carmona I (2016) New records of sabellids and serpulids (Polychaeta: Sabellidae, Serpulidae) from the Tropical Eastern Pacific. Zootaxa 4184 (3): 401–457. https://doi.org/10.11646/zootaxa.4184.3.1

Bastida-Zavala JR, García-Madrigal MS, Rosas-Alquicira EF, López-Pérez RA, Benítez-Villalobos F, Meraz-Hernando JF, Torres-Huerta AM, Montoya-Márquez A, Barrientos-Luján NA (2013) Marine and coastal biodiversity of Oaxaca, México. Check List 9 (2): 329–390. https://doi.org/10.15560/9.2.329

Ben-Eliahu MN, Hove HA ten (2011) Serpulidae (Annelida: Polychaeta) from the Suez Canal—From a Lessepsian migration perspective (a monograph). Zootaxa 2848: 1–147. https://doi.org/10.11646/ZOOTAXA.2848.1.1

Berkeley E, Berkeley C (1958) Some notes on a collection of Polychaeta from the northeast Pacific south of latitude 32° N. Canadian Journal of Zoology 36: 399–407.https://doi.org/10.1139/z58-034

Bishop MJ, Mayer-Pinto M, Airoldi L, Firth LB, Morris RL, Loke LHL, Hawkins SJ, Naylor LA, Coleman RA, Chee SY, Daffon KA (2017) Effects of ocean sprawl on ecological connectivity: impacts and solutions. Journal of Experimental Marine Biology and Ecology 492: 7–30. https://doi.org/10.1016/j.jembe.2017.01.021

Brusca RC (1980) Common intertidal invertebrates of the Gulf of California. 2nd edition, revised and expanded. The University of Arizona Press, Tucson, USA, 513 pp.

Busk G (1886) Report on the Polyzoa collected by H.M.S. Challenger during the years 1873-1876. Part 2. The Cyclostomata, Ctenostomata and Pedicellinea. Report on the Scientific Results of the Voyage of H.M.S. Challenger during the years 1873–76. Zoology 17 (50): 1–47.

Calder DR (1988) Shallow-waters hydroids of Bermuda: The Athecathe. Life Sciences Contributions, Royal Ontario Museum 148: 1–107. https://doi.org/10.5962/bhl.title.52225

Calder DR (2010) Some anthoathecate hydroids and limnopolyps (Cnidaria, Hydrozoa) from the Hawaiian archipelago. Zootaxa 2590: 1–91. https://doi.org/10.11646/zootaxa.2590.1.1

Calder DR (2013) Some shallow-waters hydroids (Cnidaria: Hydrozoa) from the central east coast of Florida, USA. Zootaxa 3648 (1): 1–72. https://doi.org/10.11646/zootaxa.3648.1.1

Calder DR, Mallinson JJ, Collins K, Hickman CP (2003) Additions to the hydroids (Cnidaria) of the Galapagos, with a list of species reported from the islands. Journal of Natural History 37: 1173–1218. https://doi.org/10.1080/00222930110116039

Calder DR, Carlton JT, Larson K, Mallinson JJ, Choong HHC, Keith I, Ruiz GM (2019) Hydroids (Cnidaria, Hydrozoa) from marine fouling assemblages in the Galapagos Islands, Ecuador. Aquatic Invasions 1 (14): 21–58. https://doi.org/10.3391/ai.2019.14.1.02

Calder DR, Carlton JT, Keith I, Ashton GV, Larson K, Ruiz GM, Herrera E, Golfin G (2022) Biofouling hydroids (Cnidaria: Hydrozoa) from a Tropical Eastern Pacific Island, with remarks on their biogeography. Journal of Natural History 56: 565–606. https://doi.org/10.1080/00222933.2022.2068387

Calder DR, Carlton JT, Keith I, Larson K, McCann L, Geller J, Wheelock M, Choong HHC, Ruiz GM (2021) Additions to the hydroids (Cnidaria, Hydrozoa) of marine fouling communities on the mainland of Ecuador and in the Galapagos Islands. Aquatic Invasions 16 (2): 208–252. https://doi.org/10.3391/ai.2021.16.2.02

Cantera JR, Contreras R (1988) Bivalvos perforadores de esqueletos de corales escleractiniarios en la Isla de Gorgona, Pacífico Colombiano. Revista de Biología Tropical 36 (1): 151–158.

Cañete JI, López JL, Mutschke E (2019) *Ascidia ceratodes* (Huntsman, 1912) (Tunicata: Ascidiidae) off the northern Chilean coast: new record. Latin American Journal of Aquatic Research 47 (1): 184–189. https://doi.org/10.3856/vol47-issue1-fulltext-20

Capa M, López E (2004) Sabellidae (Annelida: Polychaeta) living in blocks of dead coral in the Coiba National Park, Panama. Journal of the Marine Biological Association of the United Kingdom 84: 63–72. https://doi.org/10.1017/S0025315404008926h

Capa M, Murray A (2015) A taxonomic guide to the fanworms (Sabellidae, Annelida) of Lizard Island, Great Barrier Reef, Australia, including new species and new records. Zootaxa 4019 (1): 98–167. https://doi.org/10.11646/zootaxa.4019.1.8

Carballo JL (2006) Aportación al conocimiento de la fauna de ascidias del litoral Pacífico de México. Universidad Nacional Autónoma de México. Project BC005, Final Report, SNIB-CONABIO, México, D.F. 51 pp.

Carlton JT (1987) Patterns of transoceanic marine biological invasions in the Pacific Ocean. Bulletin of Marine Science 41: 452–465.

Carpenter PP (1857) Catalogue of the collection of Mazatlán shell, in the British Museum. Trustees of the British Museum, London, United Kingdom, 552 pp.

Carpenter PP (1864) Review of Prof. C.B. Adams's 'Catalogue of the shells of Panama,' from the type specimens. Proceedings of the Zoololgical Society of London 1863: 339–369.

Chen HN, Tsang LM, Chong VC, Chan BKK (2014) Worldwide genetic differentiation in the common fouling barnacle, *Amphibalanus amphitrite*. Biofouling 30 (9): 1067–1078. https://doi.org/10.1080/08927014.2014.967232

Çinar ME, Noglu M, Bilecenoğlu, Özturk B. Katagan T, Aysel V (2005) Alien species on the coasts of Turkey. Mediterranean Marine Science 6 (2): 119–146. https://doi.org/10.12681/mms.187

Çinar ME (2009) Alien polychaete species (Annelida: Polychaeta) on the Southern coast of Turkey (Levantine Sea, eastern Mediterranean), with 13 new records for the Mediterranean Sea. Journal of Natural History 43: 37–38. https://doi.org/10.1080/00222930903094654

Clark SF (1875) Descriptions of new and rare species of hydroids from the New England coast. Transactions of the Connecticut Academy of Arts and Sciences 3: 58–66.

Cohen AN, Harris LH, Bingham BL, Carlton JT, Chapman JW, Lambert CC, Lambert G, Ljubenkov JC, Murray SN, Rao LC, Reardon K, Schwindt E (2005) Rapid assessment survey for exotic organisms in southern California bays and harbors, and abundance in port and non-port areas. Biological Invasions 7: 995–1002. https://doi.org/10.1007/s10530-004-3121-1

Coles SL, DeFelice RC, Eldrege LG, Carlton JT (1999) Historical and recent introductions of non-indigenous marine species into Pearl Harbor, Oahu, Hawaiian Islands. Marine Biology 135: 147–158. https://doi.org/10.1007/s002270050612

Cruz-Barraza JA, Carballo JL (2008) Taxonomy of sponges (Porifera) associated with corals from the Mexican Pacific Ocean. Zoological Studies 47: 741–758.

Cutler EB (1994) The Sipuncula, their systematics, biology and evolution. Cornell University, New York, USA, 453 pp.

Darwin C (1854) A monograph on the sub-class Cirripedia, with figures of all the species. The Balanidae, (or sessile cirripedes); the Verrucidae. Ray Society, London, United Kingdom, 400 pp.

Davidson SK, Haygood MG (1999) Identification of sibling species of the bryozoan *Bugula neritina* that produce different anticancer bryostatins and harbor distinct strains of the bacterial symbiont "*Candidatus endobugula sertula*". Biological Bulletin 196: 273–280. https://doi.org/10.2307/1542952

Day JH (1967) A monograph on the Polychaeta of South Africa. Part 2: Sedentaria. British Museum (Natural History), London, United Kingdom.

Day JH (1973) New Polychaeta from Beaufort with a key to all species recorded from North Carolina. NOAA Technical Report. NMFS CIRC-375, Seattle. https://doi.org/10.5962/bhl.title.62852

Dean HK (2001) Marine biodiversity of Costa Rica: the phyla Sipuncula and Echiura. Revista de Biología Tropical 2: 85–90.

Dean HK, Sibaja-Cordero JA, Cortés J, Vargas R and Kawauchi GY (2010) Sipunculans and echiurans of Isla del Coco (Cocos Island), Costa Rica. Zootaxa 2557 (1): 60–68. https://doi.org/10.11646/zootaxa.2557.1.6

De Barros RC, Rocha RM (2021) Genetic analyses reveal cryptic diversity in the widely distributed *Styela canopus* (Ascidiacea:Styelidae). Invertebrate Systematics 35: 298–311. https://doi.org/10.1071/is20058

De León-González JA, Bastida-Zavala JR, Mendoza-Alfaro R, Luna S (2021a) Invasive species in Mexican marine ecosystems. In: Palluaiah, T, Ielmini MR (Eds.) Invasive alien species: observations and issues from around the world. Issues and invasions in the Americas and the Caribbean. John Wiley and Sons Ltd., Oxford, United Kingdom, 93–118.

De León-González JA, Bastida-Zavala JR, Carrera-Parra LF, García-Garza ME, Salazar-Vallejo SI, Solís-Weiss V, Tovar-Hernández MA (2021b) Anélidos marinos de México y América Tropical. Universidad Autónoma de Nuevo León, Monterrey, México, 1054 pp.

Del Pasqua M, Schulze A, Tovar-Hernández MA, Keppel E, Lezzi M, Gambi MC, Giangrande A (2018) Clarifying the taxonomic status of the alien species *Branchiomma bairdi* and *Branchiomma boholense* (Annelida: Sabellidae) using molecular and morphological evidence. PloS ONE 13 (5): e0197104. https://doi.org/10.1371/journal.pone.0197104

Díaz-Castañeda V, Valenzuela-Solano S (2009) Polychaete fauna in the vicinity of bluefi n tuna seacages in Ensenada, Baja California, Mexico. Zoosymposia 2: 505–526. https://doi.org/10.11646/zoosymposia.2.1.35

Dillwyn LW (1817) A descriptive catalogue of recent shells, arranged according to the Linnean method, with particular attention to the synonymy. John & Arthur Arch, Cornhill, London, United Kingdom, 530 pp.

El Nagar A, Huys R, Bishop JDD (2010) Widespread occurrence of the Southern Hemisphere ascidian *Corella eumyota* Traustedt, 1882 on the Atlantic coast of Iberia. Aquatic Invasions 5 (2): 169–173. https://doi.org/10.3391/ai.2010.5.2.06

Emschermann P (1993) On Antarctic Entoprocta: nematocyst-like organs in a loxosomatid, adaptative developmental strategies, host specificity, and bipolar occurrence of species. The Biological Bulletin 184 (2): 153–185. https://doi.org/10.2307/1542225

Fauvel P (1919) Annélides polychètes de la Guyane française. Bulletin du Muséum national d'Histoire naturelle 23: 472–479.

Fisher WK (1952) The sipunculid worms of California and Baja California. Proceedings of the United States National Museum 102 (3306): 371–450.

Fraser CM (1938a) Hydroids of the 1934 Allan Hancock Pacific Expedition. Allan Hancock Pacific Expeditions 4 (1): 1–105.

Fraser CM (1938b) Hydroids of the 1936 and 1937 Allan Hancock Pacific Expeditions. Allan Hancock Pacific Expeditions 4 (2): 107–127.

Fraser CM (1948) Hydroids of the Allan Hancock Pacific Expeditions since March 1938. Allan Hancock Pacific Expeditions 4 (5): 179–335.

Galván-Villa CM, Ríos-Jara E (2018) First detection of the alien snowflake coral *Carijoa riisei* (Duchassaing and Michelotti, 1860) (Cnidaria: Alcyonacea) in the port of Manzanillo in the Mexican Pacific. BioInvasion Records 7 (1): 1–6. https://doi.org/10.3391/bir.2018.7.1.01

Galván-Villa CM, Tovar-Hernández MA, Rodríguez-Zaragoza FA, Esqueda-González MC, Sánchez-Rodríguez J, Ríos-Jara E (2023) Effect of the alien octocoral *Carijoa riisei* on benthic fauna assemblages on natural and artificial substrates. Marine Ecology 44 (4): e12756. https://doi.org/10.1111/maec.12756

Gamboa-Contreras JA, Tapia-García M (1998) Invertebrados bentónicos de la plataforma continental interna. In: Tapia-García (Ed.) El golfo de Tehuantepec. El Ecosistema y sus recursos. Universidad Autónoma Metropolitana, Iztapalapa, México, 103–128.

García-Madrigal MS, Pérez-Enriquez VI, Jarquín-Martínez U (2022) Crustáceos (Arthropoda: Crustacea). In: Bastida-Zavala JR, García-Madrigal MS (Eds.) Invertebrados marinos y costeros del Pacífico sur de México. Universidad del Mar and Geomare, Puerto Ángel, Oaxaca, México, 199–275.

Gee JM (1963) On the taxonomy and distribution in South Wales of *Filograna*, *Hydroides* and *Mercierella* (Polychaeta: Serpulidae). Annals and Magazine of Natural Historty Serie 13, 6 (72): 705-715.

Goldburg R, Triplett T (1997) Murky waters. Environmental Defense Fund, Nueva York, USA, 196 pp.

Goldfuss GA (1820) Handbuch der Zoologie. I. Abtheilung. Johann Leonhard Schrag, Nürnberg, Germany, 696 pp.

Gomez-Daglio L, González E (2006) The shallow-water barnacles (Cirripedia, Balanomorpha) of Bahía de La Paz, Baja California Sur, México, including seven previously unrecorded species and amended descriptions of three species. Sessile Organisms 23 (2): 1–12. https://doi.org/10.4282/sosj.23.2_1

Gómez-Vásquez JD (2024) New records and five new species of sipunculans (Sipuncula) from the central and northwestern Mexican Pacific. European Journal of Taxonomy 924: 179–219. https://doi.org/10.5852/ejt.2024.925.2463

González-Villarreal LM (2005) Guía ilustrada de los gasterópodos marinos de la Bahía de Tenacatita, Jalisco, México. Scientia-CUCBA 7 (1): 1–85.

Gould AA (1841) A report on the Invertebrata of Massachusetts, comprising the Mollusca, Crustacea, Annelida, and Radiata. Folsom, Wells, and Thurston, Cambridge, Massachusetts, USA, 373 pp.

Grube E (1858) Enumeratio Annulatorum, quae in itinere per Indiam occidentalem et Americam centralem annis 1845–1848 suscepto legit cl. A.S. Örsetd, adjectis speciebus nonnullis a cl. Köyero in itinere ad Americam meridionalem colectis, Annulata Örstediana, Copenhagen: Videnskabelige Meddelelser fra Dansk naturhistorisk Forening I Kjobenhaven 105–120.

Hanley S (1845) A description of new species of *Ostrea* in the collection of H. Cuming, Esq. Proceedings of the Zoological Society of London 13: 105–107.

Hara U (2015) Bryozoan internal moulds from the La Meseta Formation (Eocene) of Seymour Island, Antarctic Peninsula. Polish Polar Research 36 (1): 25–49. https://doi.org/10.1515/popore–2015–0003

Harding JP (1962) Darwin´s type specimens of varieties of *Balanus amphitrite*. Bulletin of the British Museum Natural History 9: 273–296.

Harmer SF (1957) The Polyzoa of the Siboga-Expedition. Part 4. Cheilostomata, Ascophora II. Siboga Expeditions 28: 641–1147.

Harry HW (1985) Synopsis of the supraspecific classification of living oysters (Bivalvia: Gryphaeidae and Ostreidae). The Veliger 28: 121–158.

Hastings AB (1930) Cheilostomatous Polyzoa from the vicinity of the Panama Canal collected by Dr. C. Crossland on the Cruise of the S. Y. "St. George". Proceedings of the Zoological Society of London 99 (4): 697–740. https://doi.org/10.1111/j.1096-3642.1929.tb01453.x

Haswell WA (1883) On some new Australian tubicolous annelids. Proceedings of the Linnean Society of New South Wales 7 (4): 633–1147.

Hendrickx ME, Salgado-Barragán J, Toledano-Granados A, Cordero-Ruiz M (2014) Los moluscos (Pelecypoda, Gastropoda, Cephalopoda, Polyplacophora y Scaphopoda) recolectados en el SE del golfo de California durante las campañas SIPCO a bordo del B/O "El Puma. Elenco faunístico. Revista Mexicana de Biodiversidad 85: 682–722. https://doi.org/10.7550/rmb.43077

Henry DP (1941) Notes on some sessile barnacles from Lower California and the west coast of Mexico. Proceedings of the New England Zoological Club 23: 99–106.

Henry DP (1943) Notes on some barnacles from Gulf of California and the west coast of Mexico. Proceedings of the United States National Museum 93: 367–373. https://doi.org/10.5479/si.00963801.93-3166.367

Henry DP (1960) Thoracic Cirripedia of the Gulf of California. University of Washington Public of Oceanography 4: 135–58.

Henry DP, McLaughlin PA (1975) The barnacles of the *Balanus amphitrite* complex (Cirripedia, Thoracica). Zoologische Verhandelingen 141: 3–254.

Herdman WA (1886) Report on the Tunicata collected during the voyage of H.M.S. Challenger during the years 1873–1876. Part 2. Ascidiae compositae. The Voyage of H.M.S. Challenger, Zoology 14: 429.

Holguín-Quiñones OE, González-Pedraza AC (1989) Moluscos de la franja costera del Estado de Oaxaca, México. Atlas CICIMAR, 7: 1–228.

Hove HA ten (1974) Notes on *Hydroides elegans* (Haswell, 1883) and *Mercierella enigmatica* Fauvel, 1923, alien serpulid polychaetes introduced into the Netherlands. Bulletin Zoologisch Museum, Universiteit van Amsterdam 4 (5): 45–51.

Humara-Gil KJ, Cruz-Gómez C (2018) New records of benthic hydroids (Cnidaria: Hydrozoa) from the coast of Oaxaca, México. Zootaxa 4455 (3): 454–470. https://doi.org/10.11646/zootaxa.4455.3.3

Humara-Gil KJ, Cruz-Gómez C (2019) First record of the non-indigenous bryozoan *Amathia verticillata* (delle Chiaje, 1822) (Bryozoa, Vesiculariidae) in the southern Mexican Pacific. Check List 15 (3): 515–522. https://doi.org/10.15560/15.3.515

Huntsman AG (1912) Ascidians from the coasts of Canada. Transactions of the Canadian Institute 1911: 111–148. https://doi.org/10.5962/bhl.part.13136

Imajima M (1976) Serpulidae (Annelida, Polychaeta) from Japan. I. The genus *Hydroides*. Bulletin of the National Science Museum, Series A (Zoology) 2 (4): 229–247.

Imajima M (1977) Serpulidae (Annelida, Polychaeta) collected around Chichi-jima (Ogasawara Islands). Memoirs of the National Science Museum 10: 89–111.

Imajima M (1978) Serpulidae (Annelida, Polychaeta) collected around Nii-jima and Ō-shima, Izu Islands. Memoirs of the National Science Museum, Tokyo 11: 49–72.

Imajima M (1982) Serpulinae (polychaetous annelids) from the Palau and Yap Islands, Micronesia. Proceedings of the Japanese Society of Systematic Zoology 23: 37–55.

Ishaq S, Mustaquim J (1996) Polychaetous annelids (order Sabellida) from the Karachi coast, Pakistan. Pakistan Journal of Marine Sciences 5 (2): 161–197.

Karlson RH, Osman RW (2012) Species composition and geographic distribution of invertebrates in fouling communities along the east coast of the USA: a regional perspective. Marine Ecology Progress Series 458: 255–268. https://doi.org/10.3354/meps09767

Keen M (1961) A proposed reclassification of the gastropod family Vermetidae. Bulletin of the British Museum Natural History, Zoology 7 (3): 183–213.

Keen M (1971) Sea shells of Tropical West America. Marine mollusks from Baja California to Peru. Stanford University Press, California, USA, 1064 pp.

Keppel E, Tovar-Hernández MA, Ruiz G. (2018) New records of the non-indigenous species *Branchiomma bairdi* and *B. conspersum* (Polychaeta: Sabellidae) on the Pacific coast of North America. BioInvasions Records 7 (3): 229–236. https://doi.org/10.3391/bir.2018.7.3.03

Keppel E, Keith I, Ruiz GM, Carlton JT (2019) New records of native and non-indigenous polychaetes (Annelida: Polychaeta) in the Galapagos Islands. Aquatic Invasions 14 (1): 59–84. https://doi.org/10.3391/ai.2019.14.1.03

Kim J, Ubagan M, Kwon S, Kim IH, Shin S (2022) Variation in genetics, morphology, and recruitment of the invasive barnacle *Amphibalanus eburneus* (Gould, 1841) in the southern Korean peninsula. PeerJ: 10:e14002. https://doi.org/10.7717/peerj.14002

Lakshmana Rao MV (1969) Fouling serpulids from some Indian harbours. Journal of Timber Developers Association of India 15 (2): 1–20.

Lambert CC, Lambert G (1998) Non-indigenous ascidians in southern California harbors and marinas. Marine Biology 130: 675–688. https://doi.org/10.1007/s002270050289

Lambert CC, Lambert G (2003) Persistence and differential distribution of nonindigenous ascidians in harbors of the southern California Bight. Marine Ecology Progress Series 259: 145–161. https://doi.org/10.3354/meps259145

Lambert G (2019) Fouling ascidians (Chordata: Ascidiacea) of the Galapagos: Santa Cruz and Baltra Islands. Aquatic Invasions 14 (1): 132–149. https://doi.org/10.3391/ai.2019.14.1.05

Lewis JA, Watson C, ten Hove HA (2006) Establishment of the Caribbean serpulid tubeworm *Hydroides sanctaecrucis* Krøyer [in] Mörch, 1863, in northern Australia. Biological Invasions 8: 665–671. https://doi.org/10.1007/s10530-005-2062-7

Linnaeus C (1758) Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Laurentii Salvii, Holmiae [Stockholm]. Vol. Tomus I, Editio decima, reformata: 1–824.

Lodeiros CJ, Valentich-Scott P, Chávez-Villalba J, Mazón-Suástegui JM, Grijalva-Chon JM (2020) Tropical and subtropical Ostreidae of the American Pacific: taxonomy, biology, ecology, and genetics. Journal of Shellfish Research 39 (2): 181–206. https://doi.org/10.2983/035.039.0202

Long ER (1974) Marine fouling studies of Oahu, Hawaii. The Veliger 17 (1): 23–36.

López-García E, San Martín Peral G, Caldera de Codina P, Capa Corrales M (1997) La fauna de anélidos poliquetos del Parque Nacional de Coiba (Panama). In: Castroviejo S (Ed.), Flora y fauna del Parque Nacional de Coiba (Panama): Inventario preliminar. DECI & Agencia Española Cooperación Internacional, Madrid, Spain, 57–73.

Lozano-Cortés DF, Londoño-Cruz E (2013) Checklist of barnacles (Crustacea: Cirripedia: Thoracica) from the Colombian Pacific. Marine Biodiversity 43: 463–471. https://doi.org/10.1007/s12526-013-0175-2

Mackie JA, Keough MJ, Christidis L (2006) Invasion patterns inferred from cytochrome oxidase I sequences in three bryozoans, *Bugula neritina*, *Watersipora subtorquata*, and *Watersipora arcuata.* Marine Biology 149: 285–295. https://doi.org/10.1007/s00227-005-0196-x

Marcus E (1937) Bryozoarios marinhos brasileiros I. Boletins da Faculdade de Philosophia, Sciencias e Letras, Zoologia 1: 1–224. https://doi.org/10.11606/issn.2526-4877.bsffclzoologia.1937.113912

Matsui T, Shane G, Newman W (1964) On *Balanus eburneus* Gould (Cirripedia, Thoracica) in Hawaii. Crustaceana 7: 141–145. https://doi.org/10.1163/156854064X00380

McGovern TM, Helberg ME (2003) Cryptic species, cryptic endosymbionts, and geographical variation in chemical defenses in the bryozoan *Bugula neritina*. Molecular Ecology 12: 1207–1215. https://doi.org/10.1046/j.1365-294X.2003.01758.x

McIntosh WC (1885) Report on the Annelida Polychaeta collected by H.M.S. Challenger during the years 1873–1876. Zoology 12 (34): 1–554.

Medina-Rosas P, Tovar-Hernández MA (2012) Capítulo 7, Bryozoa, Cnidaria, Kamptozoa. In: Low-Pfeng AM, Peters-Recagno EM (Eds.) Invertebrados marinos exóticos en el Pacífico mexicano. Geomare, A. C. and INE-SEMARNAT, México, 107–130.

Mendoza-Becerril MA, Estrada-González MC, Mazariegos-Villarreal A, Restrepo-Avendaño L, Villar-Beltrán RD, Agüero J, Cunha AF (2020) Taxonomy and diversity of Hydrozoa (Cnidaria, Medusozoa) of La Paz Bay, Gulf of California. Zootaxa 4808: 1–37. https://doi.org/10.11646/zootaxa.4808.1.1

Michaelsen W (1904) Revision der compositen Styeliden order Polyzoen. Mitteilungen aus dem Naturhistorischen Museum Hamburg, 21: 1–124.

Miglietta MP, Odegard D, Faure B, Faucci A (2015) Barcoding techniques help tracking the evolutionary history of the introduced species *Pennaria disticha* (Hydrozoa, Cnidaria). PLoS ONE 10 (12): e0144762. https://doi.org/10.1371/journal.pone.0144762

Miglietta MP, Maggioni D, Matsumoto Y (2018) Phylogenetics and species delimitation of two hydrozoa (phylum Cnidaria): *Turritopsis* (McCrady, 1857) and *Pennaria* (Goldfuss, 1820). Marine Biodiversity 49: 1085–1100. https://doi.org/10.1007/s12526-018-0891-8

Milne-Edwards H (1841) Observations sur les Ascidies composes des côtes de la Manche. Mémoires de l'Académie des sciences de l'Institut de France 18: 217–326.

Monniot C, Monniot F (1987) Les ascidies de Polynésie française. Mémoires du Muséum national d'Histoire naturelle, Sér. A Zoologie 136: 1–155.

Monniot C, Monniot F, Laboute P (1991) Coral reef ascidians of New Caledonia. Mémoires du Muséum national d'Histoire naturelle, Éditions de l'ORSTOM, Collection Faune tropicale (30): 1–247.

Monniot F, Monniot C (2001) Ascidians from the tropical western Pacific. Zoosystema 23 (2): 201–383.

Monro CCA (1938) On a new species of serpulid polychaete from the Shoreham Harbour Canal, Sussex. Annals and Magazine of Natural History 11 (1): 73–78.

Morales de Anda DE, Villalobos-Guerrero TF, Salazar-Silva P (2013) Poliquetos (Annelida: Polychaeta) de Jalisco y Colima. In: Franco-Gordo MC (Ed.), Inventario de biodiversidad de la costa sur de Jalisco y Colima. Universidad de Guadalajara, Jalisco, México, 101–135.

Mörch OAL (1863) Revisio critica Serpilidaraum. Et bidrag til røromenes naturhistorie. Naturhistorisk Tidsskrift Henrik Krøyer, København, Series 3, 1: 347–470.

Moreno-Dávila BB (2010) Ascidias (Tunicata: Ascidecea) de Oaxaca, México. Bachelor thesis. Universidad del Mar, Oaxaca, México, 80 pp.

Nelson-Smith A (1967) Catalogue of main marine fouling organisms (found on ships coming into European waters). Vol. 3. Serpulids. Organization for Economic Co-operation and Development, Paris, France, 79 pp.

Oka A (1927) Zur Kenntnis der japanischen Botryllidae (Vorläufige Mitteilug). Proceedings of The Imperial Academy Tokyo 3: 607–609. https://doi.org/10.2183/pjab1912.3.607

Okolodkov YB, García-Escobar H (2014) Agua de lastre y transporte de los organismos incrustantes, leyes y acciones: perspectivas para México. In: Low A, Quijón PA, Peters EM (Eds.) Especies invasoras acuáticas: Casos de estudio en ecosistemas de México. Mexico City, México, 55–80.

Okolodkov YB, Bastida-Zavala R, Ibáñez AL, Chapman JW, Suárez-Morales E, Pedroche F, Gutiérrez-Mendieta FJ (2007) Especies acuáticas no indígenas en México. Ciencia y Mar 11 (32): 29–67.

Olsson AA (1961) Mollusks of the Tropical Eastern Pacific, particularly from the southern half of the Panamic-Pacific faunal province (Panama to Peru). Panamic·Pacific Pelecypoda. Paleontological Research Institution, Ithaca, USA. https://doi.org/10.5962/bhl.title.6853

Osburn R (1940) Bryozoa of Porto Rico with a resume of West Indian Bryozoan fauna. Scientific survey of Porto Rico and the Virgin Islands 16: 321–486.

Osburn R (1950). Bryozoa of the Pacific coast of America. Part 1, Cheilostomata - Anasca. Allan Hancock Pacific Expeditions 14 (1): 1–269. https://doi.org/10.5962/bhl.title.6542

Osburn R (1952) Bryozoa of the Pacific coast of America. Part 2, Cheilostomata - Ascophora. Allan Hancock Pacific Expeditions 14 (2): 271–611. https://doi.org/10.5962/bhl.title.6542

Osburn R (1953) Bryozoa of the Pacific coast of America III. Part 3, Cyclostomata, Ctenostomata, Entoprocta and Addenda. Allan Hancock Pacific Expeditions 14 (3): 613–841. https://doi.org/10.5962/bhl.title.6542

Pazoki S, Rahimian H, Naderloo R, Kupriyanova E (2023) Intertidal calcareous tubeworms (Annelida: Serpulidae) of the Persian Gulf and Gulf of Oman. Regional Studies in Marine Science 67: 103184. https://doi.org/10.1016/j.rsma.2023.103184

Pérez-Portela R, Arranz V, Rius M, Turox X (2013) Cryptic speciation or global spread? The case of a cosmopolitan marine invertebrate with limited dispersal capabilities. Scientific Reports 3: 3197. https://doi.org/10.1038/srep03197

Perkins TH (1984) Revision of *Demonax* Kinberg, *Hypsicomus* Grube, and *Notaulax* Tauber, with a review of *Megalomma* Johansson from Florida (Polychaeta: Sabellidae). Proceedings of the Biological Society of Washington 97 (2): 285–368.

Pillai TG (1960) Some marine and brackish water serpulid polychaeta from Celyon, including new genera and species. Ceylon Journal of Science (Biological Sciences) 3 (1): 1–40.

Pillai TG (1965) Annelida Polychaeta from the Philippines and Indonesia. Ceylon Journal of Science (Biological Sciences) 5 (2): 110-177.

Pilsbry H (1916) The sessile barnacles (Cirripedia) contained in the collections of the U.S. National Museum; including a monograph of the American species. Bulletin of the United States National Museum 93: 1–366. https://doi.org/10.5962/bhl.title.1144

Pitombo FB (2004) Phylogenetic analysis of the Balanidae (Cirripedia, Balanomorpha). Zoologica Scripta 33: 261–276. Ramalhosa P, Camacho-Cruz K, Bastida-Zavala JR, Canning-Clode J (2014) First record of *Branchiomma bairdi* McIntosh, 1885 (Polychaeta: Sabellidae) from Madeira Island, Portugal (Northeastern Atlantic Ocean). BioInvasions Records: International Journal of Field Research on Biological Invasions 3 (3): 1–5. https://doi.org/10.3391/bir.2014.3.4.04

Rioja E (1941a) Estudios anelidológicos II. Observaciones acerca de varias especies del género *Hydroides* Gunnerus (sensu Fauvel) de las costas mexicanas del Pacífico. Anales del Instituto de Biología 12: 161–175.

Rioja E (1941b) Estudios anelidológicos, III. Datos para el conocimiento de la fauna de poliquetos de las costas mexicanas del Pacífico. Anales del Instituto de Biología 12: 669–746.

Rioja E (1942) Estudios anelidológicos IV. Observaciones sobre especies de serpúlidos de las costas del Pacífico de México, con descripción de una especie nueva del género *Hydroides*. Anales del Instituto de Biología 13 (1): 125–135.

Rioja E (1946) Estudios Anelidológicos XIV. Observaciones sobre algunos poliquetos de las costas del Golfo de México. Anales del Instituto de Biología 17: 193–203.

Rioja E (1947) Estudios anelidológicos XVII. Contribución al conocimiento de los anélidos poliquetos de Baja California y Mar de Cortés. Anales del Instituto de Biología 18 (1): 197–224.

Rioja E (1958) Estudios Anelidológicos XXII. Datos para el conocimiento de la fauna anélidos poliquetos de las costas orientales de México. Anales del Instituto de Biología 29: 219–301.

Rioja E (1960) Estudios anelidológicos. XXIII. Contribucion al conocimiento de los anélidos poliquetos de las islas de Revillagigedo. Anales del Instituto de Biología 30: 243–259.

Rioja E (1963) Estudios anelidológicos XXVI. Algunos anélidos poliquetos de las costas del Pacífico de México. Anales del Instituto de Biología 33 (1–2): 131–229.

Ritter WE, Forsyth RA (1917) Ascidians of the littoral zone of southern California. University of California Publications in Zoology 16: 439–512.

Rizgalla J, Shinn AP, Crocetta F (2019) New records of alien and cryptogenic marine bryozoan, mollusc, and tunicate species in Libya. BioInvasions Records 8: 590–597. https://doi.org/10. 3391/bir.2019.8.3.15

Robertson A (1905) Non-incrusting Chilostomatous Bryozoa of the West Coast of North America. University of California Publications in Zoology 2 (5): 235–322.

Rocha RM, Bonnet N (2009) Ascidias (Tunicata, Ascidiacea) introduzidas no Arquipélago de Alcatrazes, São Paulo. Iheringia, Série Zoologica 99 (1): 27–35. https://doi.org/10.1590/S0073-47212009000100004

Rodríguez LF, Ibarra-Obando SE (2008) Cover and colonization of commercial oyster (*Crassostrea gigas*) shells by fouling organisms in San Quintin Bay Mexico. Journal of Shellfish Research 27 (2): 337–343. https://doi.org/10.2983/0730-8000(2008)27[337:cacoco]2.0.co;2

Rodríguez-Almaraz GA, García-Madrigal MS (2014) Crustáceos exóticos invasores. In: Mendoza R. and Koleff P (Eds.) Especies acuáticas invasoras en México. Comisión Nacional para el Conocimiento y uso de la Biodiversidad, México, 347–371.

Rodríguez-Palacios CA, Michel-Arana LM, Sandoval-Díaz G, Gómez P, Green G (1988) Los moluscos de las Bahías de Huatulco y Puerto Ángel, Oaxaca. Distribución, diversidad y abundancia. Universidad y Ciencia 5 (9): 85–94. https://doi.org/10.19136/era.a5n9.418

Rodríguez-Valencia JA (2004) Respuesta de los poliquetos bentónicos a la variabilidad ambiental y condiciones El Niño en Bahía Petacalco (Guerrero, México). Ciencias Marinas 30 (4): 515–526. https://doi.org/10.7773/cm.v30i4.346

Ryland JS (1960) The British species of *Bugula* (Polyzoa). Proceedings of the Zoological Society of London 134: 65–105. https://doi.org/10.1111/j.1469-7998.1960.tb05919.x

Salcedo-Martínez S, Green G, Gamboa-Contreras A, Gómez P (1988) Inventario de Macroalgas y macroinvertebrados bénticos, presentes en áreas rocosas de la región de Zihuatanejo, Guerrero, México. Anales del Instituto de Ciencias del Mar y Linmología 15 (1): 73–96.

Salgado-Barragán J, Hendrickx ME (2002) Distribution and abundance of barnacles (Crustacea: Cirripedia) associated with prop roots of *Rhizophora mangle* L., in a lagoon of Northwest Mexico. In: Hendrickx ME (Ed.) Contribution to the Study of East Pacific Crustaceans. Vol. I. Ciencias del Mar y Limnología, Mazatlán, México, 45–60.

Salgado-Barragán J, Toledano-Granados A (2006) The false mussel *Mytilopsis adamsi* Morrison, 1946 (Mollusca: Bivalvia: Dreissenidae) in the Pacific waters of Mexico: A case of biological invasion. Hydrobiologia 563: 1–7. https://doi.org/10.1007/s10750-005-1077-5

Salgado-Barragán J, Méndez N, Toledano-Granados A (2004) *Ficopomatus miamiensis* (Polychaeta: Serpulidae) and *Styela canopus* (Ascidiacea: Styelidae), non-native species in Urías estuary, SE Gulf of California, Mexico. Cahiers de Biologie Marine 45: 167–173.

Savigny JC (1816) Memoires sur les animaux sans vertebres, Seconde Partie: Description et classification des Animaux invertébré, non articulés, connus sous les noms de Mollusques, de Radiaires, de Polypes, etc. Chez Deterville Libraire, Paris, France, 240 pp.

Schuchert P (1996) The marine fauna of New Zealand: athecate hydroids and their medusae (Cnidaria: Hydrozoa). New Zealand Oceanographic Institute Memoir 106: 1–159.

Schuchert P (2006) The European athecate hydroids and their medusae (Hydrozoa, Cnidaria): Capitata Part 1. Revue Suisse de Zoologie 113: 325–410. https://doi.org/10.5962/bhl.part.80356

Schuchert P (2007) The European athecate hydroids and their medusae (Hydrozoa, Cnidaria): Filifera Part 2. Revue Suisse de Zoologie 114: 195–396. https://doi.org/10.5962/bhl.part.80395

Schulze A, Boyle MJ, Kawauchi GY (2019) Amphinomida/Sipuncula*. In: Purschke G, Böggemann M, Westheide W (Eds.) Annelida Volume 1: Annelida Basal Groups and Pleistoannelida, Sedentaria I. Handbook of Zoology. Boston, USA, 177–201.

Schwan IDS, Brasil ACDS, Neves D, Dias GM (2015) The invasive worm *Hydroides elegans* (Polychaeta – Serpulidae) in southeastern Brazil and its potential to dominate hard substrata. Marine Biology Research 12 (1): 96–103. https://doi.org/10.1080/17451000.2015.1080370

Sheets EA, Cohen CS, Ruiz GM, Rocha RM (2016) Investigating the widespread introduction of a tropical marine fouling species. Ecology and Evolution 6 (8): 2453–2471. https://doi.org/10.1002/ece3.2065

Shenkar N, Loya Y (2009) Non-indigenous ascidians (Chordata: Tunicata) along the Mediterranean coast of Israel. Marine Biodiversity Records 2: 1–7. https://doi.org/10.1017/S1755267209990753

Silva-Morales I, Gómez-Vásquez JD (2021) First records and two new species of sipunculans (Sipuncula) from the southern Mexican Pacific. European Journal of Taxonomy 740: 77–117. https://doi.org/10.5852/ejt.2021.740.1283

Sowerby GB I (1824) The genera of Recent and fossil shells, for the use of students, in conchology and geology. G.B. Sowerby, London, United Kingdom, 274 pp. https://doi.org/10.5962/bhl.title.86281

Spivey HR (1976) The cirripeds of the Panama Canal. Corrosion Marine-Fouling 1: 43–50.

Stechow E (1914) Zur Kenntnis neuer oder seltener Hydroidpolypen, meist Campanulariden, aus Amerika und Norwegen. Zoologischer Anzeiger 45: 120–136.

Struck TH, Schuelt N, Kusen T, Hickman E, Bleidorn C, McHugh D, Halanych KM (2007) Annelid phylogeny and the status of Sipuncula and Echiura. BMC Evolutionary Biology 7: 57. https://doi.org/10.1186/1471-2148-7-57

Sun Y, ten Hove HA, Qiu JW (2012) Serpulid polychaetes from Hong Kong. Zootaxa 3424: 1–42. https://doi.org/10.11646/zootaxa.3424.1.1

Sun Y, Wong E, ten Hove HA, Hutchings PA, Williamson JE, Kupriyanova EK (2015) Revision of the genus *Hydroides* (Annelida: Serpulidae) from Australia. Zootaxa 4009 (1): 1–99. https://doi.org/10.3853/j.0067-1975.25.1959.654

Sun Y, Wong E, Tovar-Hernández MA, Williamson JE, Kupriyanova EK (2016) Is *Hydroides brachyacantha* (Serpulidae: Annelida) a widespread species? Invertebrate Systematics 30 (1): 41–59. https://doi.org/10.1071/IS15015

Terlizzi A, Faimali M (2010) Chapter 12. Fouling on artificial substrata. In: Dürr S, Thomason JC (Eds.) Biofouling. Wiley-Blackwell, Singapore, 170–184. https://doi.org/10.1002/9781444315462.ch12

Tokioka T (1953) Ascidians of Sagami Bay: Collected by his majesty the Emperor of Japan. Iwanami Shoten, Tokio, Japan, 315 pp.

Tokioka T (1967) Pacific Tunicata of the United States National Museum. Bulletin of the United States Natural Museum 251: 1–247. https://doi.org/10.5479/si.03629236.251.1

Tovar-Hernández MA, Knight-Jones P (2006) Species of *Branchiomma* (Polychaeta: Sabellidae) from the Caribbean Sea and Pacific coast Panama. Zootaxa 1189: 1–37. https://doi.org/10.11646/zootaxa.1189.1.1

Tovar-Hernández MA, Yáñez-Rivera B (2012) Capítulo IX. Ficha técnica y análisis de riesgo de *Branchiomma bairdi* (McIntosh, 1885) (Polychaeta: Sabellidae). In: Low Pfeng AM, Peters Recagno EM (Eds.) Invertebrados marinos exóticos en el Pacífico mexicano, Geomare, A.C. and INE-SEMARNAT, México, 167–192. https://doi.org/10.13140/RG.2.1.5000.
2965

Tovar-Hernández MA, de León-González JA, García-Garza ME (2022) New records of two invasive ascidians in the Gulf of California (Tunicata: Ascidacea), with additional records from Veracruz, México. Geomare Zoologica 4 (2): 23–37.

Tovar-Hernández MA, Méndez N, Salgado-Barragán J (2009a) *Branchiomma bairdi*: A Caribbean hermaphrodite fan worm in the south-eastern Gulf of California (Polychaeta: Sabellidae). Marine Biodiversity Records 2: e43. https://doi.org/10.1017/S1757267209000463

Tovar-Hernández MA, Méndez N, Villalobos-Guerrero TF (2009b) Fouling polychaete worms from the Southern Gulf of California: Sabellidae and Serpulidae. Systematics and Biodiversity 7 (3): 319–336. https://doi.org/10.1017/S1477200009990041

Tovar-Hernández MA, Villalobos-Guerrero TF, Yáñez-Rivera B, Aguilar-Camacho JM, Ramírez-Santana ID (2012) Guía de Invertebrados acuáticos exóticos en Sinaloa. Geomare, A.C., USFWS, INESEMARNAT, Mazatlán, Sinaloa, México.

Tovar-Hernández MA, Yáñez-Rivera B, Villalobos-Guerrero TF, Aguilar-Camacho JM, Ramírez-Santana ID (2014) Invertebrados marinos exóticos en el Golfo de California. In: Low Pfeng AM, Quijón PA, Peters Recagno EM (Eds.) Especies invasoras acuáticas: Casos de estudio en ecosistemas de México. Secretaria de Medio Ambi-

ente y Recursos Naturales, Instituto Nacional de Ecología y Cambio Climático, México, 381–410. https://doi.org/10.13140/2.1.1221.7923

Turgeon DD, Lyons WG, Mikkelsen P, Rosenberg G, Moretzsohn F (2009) Bivalvia (Mollusca) of the Gulf of México. In: Felder DL, Camp DK (Eds.) Gulf of México—origins, water, and biota, Biodiversity. Texas A & M Press, Texas, US, 711–744.

Ulman A, Ferrario J, Occhpinti-Ambrogi A, Arvanitidis C, Bandi A, Bertolino M, Bogi C, Chatzigeorgiou G, Çiçek BA, Deidun A, Ramos-Espla A, Koçak C, Lorenti M, Martinez-Laiz G, Merlo G, Princisgh E, Scribano G, Marchini A (2017) A massive update of non-indigenous species records in Mediterranean marinas. PeerJ 5: e3954. https://doi.org/10.7717/peerj.3954

Van Name WG (1921) Ascidians of the west Indian region and Southeastern United States. Bulletin of the American Museum of Natural History 44 (16): 283–494.

Van Name WG (1945) The North and South American ascidians. Bulletin of the American Museum of Natural History 84: 1–476.

Villalobos-Guerrero TF, Yáñez-Rivera B, Tovar-Hernández MA (2012) Chapter IV: Polychaeta. In: Low Pfeng AM, Peters Recagno EM (Eds.) Invertebrados marinos exóticos en el Pacífico mexicano, Geomare, A.C. and INE-SEMARNAT, México, 45–66.

Wasson K, Mariscal RN (2007) Kamptozoa (Entoprocta). In: Carlton JT (Ed.) The light and Smith manual. Intertidal invertebrates from central California to Oregon, 4th ed. University of California Press, USA, 283–287.

Weisbord NE (1964) Late Cenozoic scaphopods and serpulid polychaetes from North Venezuela. Bulletins of American Paleontology 47 (214): 111–204.

Winston JE (1982) Marine bryozoans (Ectoprocta) of the Indian River Area (Florida). American Museum Natural History Bulletin 173 (2): 99–176.

WoRMS Editorial Board (2024) World Register of Marine Species. Available from https://www.marinespecies.org at VLIZ. Accessed 2019-06-01 to 2024-01-30. https://doi.org/10.14284/170

Yáñez-Rivera B, Tovar-Hernández MA, Galván-Villa CM, Ríos-Jara E (2020) Tubicolous polychaete worms (Annelida) from Bahía de Chamela Islands Sanctuary, Mexico, with the description of a new bamboo worm. Biodiversity Data Journal 8: e57572. https://doi.org/10.3897/BDJ.8.e57572

Zaniolo G, Brunetti R, Burighel P (1998) Brood pouch differentiation in *Botrylloides violaceus*, a viviparous ascidian (Tunicata). Invertebrate Reproduction and Development 33 (1): 11–23. https://doi.org/10.1080/07924259.1998.9652338

Zibrowius H (1970) Contribution a l'ètude des Serpulidae (Polychaeta Sedentaria) du Brésil. Boletim do Instituto Oceanográfico 19: 1–32. https://doi.org/10.1590/S0373.55241970000100001

Zibrowius H (1971) Les espèces Méditerranée du genre *Hydroides* (Polychaeta Serpulidae). Remarques sur le prétendu polymorphisme de *Hydroides uncinata*. Tethys 2: 691–746.

Zibrowius H (1973) Serpulidae (Annelida Polychaeta) des cotes Ouest de l'Afrique et des archipels voisins. Musee Royal de L'Afrique Centrale Tervuren, Belgique, Annales, Serie 8, Sciences Zoologiques 207: 1–93.

Zibrowius H (1992) Ongoing modification of the Mediterranean marine fauna and flora by the establishment of exotic species. Mésogée 51: 83–107.